



**CAN THE RAIL INDUSTRIES FLATCAR INVENTORY  
SUPPORT TWO MAJOR THEATER WARS?**

GRADUATE RESEARCH PAPER

Dwight C. Sones, Major, USAF

AFIT/GMO/ENS/00E-11

**DEPARTMENT OF THE AIR FORCE  
AIR UNIVERSITY**

**AIR FORCE INSTITUTE OF TECHNOLOGY**

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**Wright-Patterson Air Force Base, Ohio**

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Graduate Research Paper

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GRADUATE RESEARCH PAPER

Presented to the Faculty

Department of Operational Sciences

Graduate School of Engineering and Management

Air Force Institute of Technology

Air University

Air Education and Training Command

In Partial Fulfillment of the Requirements for the

Degree of Master of Mobility Studies

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Major, USAF

June 2000

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## Acknowledgments

I would like to take this opportunity to thank the many people who assisted me in the development of this paper. Without their selfless help, guidance, and direction, this research would have not been possible.

First and most importantly, I must thank my wife and son for their faithful support, ceaseless patience, and complete understanding of the many long hours spent researching, writing and editing this paper over the past year.

For those who are the true experts in this field of study, Col. Darrell Roll, Mr. Mark Metz, Ms. Carolyn Brumbaugh, Mr. David Dorfman, Mr. George Gounley, Mr. John Flagello, Mr. Jon Meyer, thank you for your insight and help.

I also would like to thank the Air Force Institute of Technology staff for their support. Dr. William Cunningham for his efforts in keeping me focused while providing real-world insight and Dr. David Vaughan for his assistance in formatting this paper.

Finally, a special thanks to the Air Mobility Warfare Center Research Librarian, Ms Janice Missildine, for her endless kindness and remarkable research assistance over the past year.

Dwight C. Sones

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**Abstract**

The ability of U.S. forces to change rapidly from a peacetime to a wartime force (to mobilize and deploy) is vitally important to national security. Successful execution of these movements depends, in large part, on the availability of the required transportation resources. Today's Army is heavily dependent on Department of Defense (DoD) and commercial railcar assets to move its wheeled/tracked vehicles from home forts to seaports of embarkation (SPOEs) to meet prescribed mobilization and deployment timelines.

The primary research question answered by this paper is: Can U.S. military and commercial flatcar inventories meet DoD mobilization requirements for Army wheeled/tracked vehicles during two near-simultaneous major theater wars (MTWs)? This paper compares commercial and military flatcar requirements as stated in DoD deployment plans with current/future flatcar inventories to determine whether railcar inventories (both commercial and DoD) are sufficient in number and type to meet a two MTW scenario.

Today's fleet of commercial and DoD flatcars is sufficient in number and type to support two near-simultaneous MTWs. However, future inventories of commercial general-purpose flatcars will likely be insufficient due to current railcar production and retirement trends. Several recommendations are presented to ensure future inventories of militarily useful flatcars will be sufficient in number and type, to meet DoD mobilization requirements in support of the two near-simultaneous MTWs.

# CAN THE RAIL INDUSTRIES FLATCAR INVENTORY SUPPORT

## TWO MAJOR THEATER WARS?

### I. Overview

The ability of U.S. forces to change rapidly from a peacetime to a wartime force (to mobilize and deploy) is vitally important to national security. The success of this transition hinges on the ability of units to move from home stations to ports of embarkation within time frames contained in operation plans. Successful execution of these movements depends in large part, on the availability of the required transportation resources. Today's Army is heavily dependent on both Department of Defense and commercial railcar assets to transport wheeled/tracked vehicles from "the forts to the ports" to meet mobilization and deployment timelines.

#### Background

During the 1970s, the U.S. railroad industry experienced a period of economic instability. Numerous railroads declared bankruptcy and deferred maintenance became a common occurrence. As a result, DoD experienced excessive shipping times, and concerns grew over whether the commercial railroad industry could support a national defense emergency (MTMCTEA, 1998:9).

In the 1980s and 1990s, growth in the rail industry came primarily from the transportation of coal and intermodal (truck trailer and container) traffic. As a result, the types of railcars used by the commercial rail industry began to change. Previously,

intermodal truck trailers and containers had been moved on general-purpose flat cars, which could easily be converted to carrying heavier/bulkier cargo such as construction equipment and oversized military vehicles (Helms, 1999:9). As intermodal rail traffic increased, railroads purchased more efficient railcars, capable of carrying longer truck trailers and double stacked containers. These new railcars permitted efficiencies necessary to make intermodal traffic profitable to the rail industry. As a result, the commercial rail industry soon found it too expensive to operate and maintain large inventories of the older--militarily useful general-purpose flatcar.

In 1992, the General Accounting Office (GAO) recommended the Department of Defense determine the number and type of military and civilian flatcars available to support military deployments. In response to this request, the Military Traffic Management Command Transportation Engineering Agency (MTMCTEA) reviewed the Association of American Railroad's (AAR) Universal Machine Language Equipment Register (UMLER) computer file and determined commercial general-purpose flatcar availability to be 16,594 railcars in 1992 (MTMCTEA, 1992:1). Follow-up studies accomplished in 1993 and 1996, revealed a steady decline to 15,099 and 11,835 cars respectively in the commercial general-purpose flatcar inventory (MTMCTEA, 1993:1 and 1997:9).

According to MTMCTEA, the absolute minimum number of general-purpose flatcars required to support Army mobilization and deployment in the two near-simultaneous MTW concept is 6,000 railcars (MTMCTEA, 1997:4). However, MTMCTEA believes that to be fully adequate, the commercial general-purpose flatcar inventory should include a 25-percent safety factor for a total of 7,500 general-purpose

flatcars. Merely having the minimum quantity of 6,000 general-purpose flatcars in the inventory could cause spot shortages and delays during a mobilization for several reasons. Up to 10-percent of the flatcars in the inventory could be down for maintenance, priority civilian traffic must still be handled, and there will always be some lost time and last minute changes in an actual mobilization (MTMCTEA, 1997:5). As recently as 1999, phone calls between MTMCTEA and commercial rail fleet managers at Union Pacific Railroad, TTX Corporation, Burlington Northern Santa Fe and Consolidated Rail Corporation indicated that there were no plans for these carriers to purchase additional general-purpose flatcars until after 2006 (MTMCTEA, 1997:11). As a result, the commercial rail industries total flatcar inventory continues to shrink, possibly jeopardizing DOD's ability to support two near-simultaneous MTWs.

### Research and Investigative Questions

The primary question addressed in this research paper is: Can U.S. military and commercial flatcar inventories meet DoD mobilization requirements for Army wheeled/tracked vehicles during two near-simultaneous major theater wars?

Secondary investigative questions addressed in this research paper are:

1. How is the commercial railroad industry involved in transporting Army wheeled/tracked vehicles?
2. What types of commercially owned railcars can be used to transport these vehicles?
3. What elements make up the DoD railcar fleet? What types of DoD railcars are used to transport Army wheeled/tracked vehicles?

4. What railcar mobilization requirements exist for Army wheeled/tracked vehicles in support of two near-simultaneous MTWs?
5. Can these mobilization requirements be met by today's and/or future commercial/DoD flatcar inventories?
6. If commercial/DoD flatcar inventories are inadequate, what options exist to correct these deficiencies in order to meet railcar mobilization requirements?

### Scope and Assumptions

This paper focuses on the total inventory of militarily useful flatcars in the commercial and DoD fleets capable of transporting Army wheeled/tracked vehicles. Comparisons will be made between the total inventory and the peak requirements for these flatcars found in DoD's initial draft of the Mobility Requirements Study 2005 and the Army's Surface Distribution Plan #2. Determinations are then made as to whether the total inventory, both commercial and DoD, is sufficient in number and type to meet mobilization requirements for the two near-simultaneous MTW concept. Since MRS-05 is only in draft form at this time, flatcar requirements depicted in this paper are interim numbers and are subject to change before the final MRS-05 is published in September 2000. Militarily useful flatcars are defined as flatcars having nailable decks and/or chain-tiedown assemblies, which permit military vehicles (wheeled/tracked) to be secured, to their decks.

During a mobilization, there are two primary periods in which a shortfall in the total flatcar inventory may occur: a shortage during the first week of mobilization (initial surge) and a shortage after the first week during peak operations.

Shortages during the first week occur when the commercial industry is not given enough time to meet military requirements. Even if the commercial industry gives the Army top priority with its flatcars, shortages could exist due to the time needed to gather and redistribute these flatcars to military installations. The Army has been working to offset any potential flatcar shortages during the first week by purchasing and prepositioning its own fleet of railcars at key military installations.

Flatcar shortages occurring after the first week of a mobilization are the most critical and are the major focus of this paper. In this scenario, the commercial industry is given adequate notice of military requirements but is unable to support them because there are physically not enough militarily useful flatcars in existence. Shortages of this type are caused by an overall shortage of militarily useful flatcars in the commercial and DoD railcar fleets.

This study assumes the commercial industry will give DoD top priority for flatcars during national mobilizations. In past national defense crises (i.e. Desert Shield/Storm), the commercial industry did provide the military with priority use of its railcar assets. This paper does not address the geographical distribution of commercial flatcars or the time it might take for commercial flatcars to be delivered to military installations for upload.

In October 1999, the Chief of Staff, United States Army (CSA), established the Army's vision for the 21<sup>st</sup> Century Army: "Soldiers on point for the nation transforming this, the most respected Army in the world, into a strategically responsive force that is dominant across the full spectrum of operations."

The vision states that the Army will be capable of putting combat force anywhere in the world within 96 hours after liftoff—in brigade combat teams for both stability and support operations and for warfighting. That capability will be built into a momentum that generates a warfighting division on the ground within 120 hours and five divisions in 30 days. Organizational structures will be designed which will generate formations which can dominate at any point on the spectrum of operations.

(Williams, 2000)

The CSA's proposal for a more strategically responsive Army has far reaching implications. Included in the CSA's proposal is a move to transition Army units from "heavy" tanks and equipment to medium-weight combat vehicles. This transition to a lighter more lethal force could potentially affect the future rail flatcar mobilization and deployment requirements of Army units equipped with "heavy" wheeled/tracked vehicles. Due to the infancy of the CSA's proposal and the many uncertainties associated with the plan, militarily-useful flatcar requirements of the 21<sup>st</sup> Century Army will not be presented in this paper.

### Preview of Remaining Chapters

Chapter II begins with a brief description of the role the commercial rail industry played in the United States' success during Operations Desert Shield/Storm. Additionally, background information is provided on the five major rail carriers and types of railcars used by these carriers to support transportation of Army wheeled/tracked vehicles.

Chapter III provides background information on the Department of Defenses' railcar fleet. The Defense Freight Railway Interchange Fleet (DFRIF), Army Strategic Mobility Program (ASMP) and captive railcar fleets are discussed. The types, sizes and carrying capacities of various DODX railcars are also presented. This chapter concludes

with a short discussion of the Army's fifteen Power Projection bases and the important role these bases play in the successful mobilization and deployment of Army units.

Chapter IV begins with an overview of DoD's Mobility Requirements Study 2005 (MRS-05) and explains the two near-simultaneous MTW concept. Railcar mobilization requirements as stated in MRS-05 and MTMC's Surface Distribution Plan #2 (SDP-2) are then presented.

Chapter V looks at the current/future commercial and DoD flatcar inventories to determine if they are sufficient in number and type to support mobilization and deployment requirements as stated in MRS-05 and SDP-2. Chapter VI offers conclusions and recommendations on the findings of the research in this paper.

## II. The Commercial Railcar Industry

### Introduction

The United States military is heavily reliant on the commercial rail industry to transport unit equipment and supplies from forts to ports in support of real world exercises and contingencies. Most recently, Operations Desert Shield/Storm demonstrated just how much the United States relies on the commercial rail industry. Tremendous amounts of unit equipment, supplies and personnel were moved from home bases to seaports of embarkation in record time.

Today, five major railroads provide the majority of the Army's rail mobilization support needed to transport wheeled/tracked vehicles. Due to the size and weight of the many of the Army's fighting vehicles, large numbers of specialized and general-purpose flatcars are needed to effectively support stated DoD mobilization and deployment requirements.

This chapter provides a brief overview of the use of commercial railroads during times of national crisis. In addition, this chapter discusses the five commercial railroads that provide the majority of support to Army units, and presents background information on the types of commercially available militarily useful railcars needed to move Army wheeled/tracked vehicles.

### Operation Desert Shield/Storm

During the Persian Gulf War, the Department of Defense relied heavily on the commercial rail industry to transport unit equipment and supplies. MTMC utilized

nearly 16,000 commercial railcar moves to transport Army units' cargo and equipment to US seaports and employed 1,400 heavy-duty flatcars to carry wheeled/tracked fighting vehicles such as the M1 and M60 tanks.

The US rail industry responded patriotically to the Desert Shield/Storm mobilization and deployment. According to the Association of American Railroads, CSX Transportation single-handedly moved 13,000 carloads of unit equipment and general cargo. Several other railroads including Conrail, Santa Fe, Union Pacific, and Norfolk Southern supplemented CSX Transportation's fleet of cars with leased railcars or cars of their own. Conrail moved 474 carloads of M1 tanks from manufacturing facilities to the port at Bayonne, New Jersey. Additionally, Conrail transported 276 carloads of "Hummer" utility vehicles and 1,209 carloads of five-ton trucks from production lines to seaports of embarkation (Matthews, 1998:166). Finally, Santa Fe and Union Pacific did their share by moving 3,851 and 2,000 carloads respectively in support of the Persian Gulf War.

Despite the heroic efforts by the commercial rail industry, transporting unit equipment in support of Operation Desert Shield/Storm almost didn't get done. According to Dick Davidson, President and CEO of Union Pacific Railroad, "it was a close fit for the rail industry" (Matthews, 1998:170). A close examination conducted by the railroad industry on the Operation Desert Shield/Storm mobilization and deployment noted several areas of concern (Hillis, 1999:7).

- "short lead times" and "inflated requirements" by the military greatly complicated the industry's ability to allocate scarce rail resources.

- The railroad's lack of information relative to military intentions early in the mobilization and deployment hindered their ability to respond promptly and efficiently.
- 60-foot and 89-foot flatcars used for carrying wheeled/tracked vehicles were especially hard to acquire for military transportation needs.
- The lack of future incentives for commercial rail companies to maintain in their inventories low revenue-producing cars and other equipment specially constructed for the military.
- In the presence of a stronger national economy, the rail industry would have been hard pressed to meet the military's requirements during Operations Desert Shield/Storm.

With further reductions in United States military presence in overseas areas, the military's reliance on the commercial rail industry will only increase. To effectively support future military conflicts and to maintain the required surge capacities, it is imperative for the Department of Defense to maintain a strong working relationship with the commercial rail industry.

#### Major Rail Carriers Used by the Department of Defense

Today, five major railroads provide the majority of rail transportation support required by Army units. These railroads include: Burlington Northern Santa Fe (BNSF) Railway, Union Pacific (UP) Railroad, Norfolk Southern (NS) Railway, CSX Transportation (CSXT) and Kansas City Southern Railroad (KCSR). Each of these railroads is discussed in the following sections.

The Burlington Northern and Santa Fe Railway Company operates one of the largest railroad networks in North America (see Figure 1). BNSF has 33,500 route miles covering 28 states and two Canadian provinces. This vast network covers the western two-thirds of the United States, stretching from major Pacific Northwest and Southern

California ports to the Midwest, Southeast and Southwest, and from the Gulf of Mexico to Canada. BNSF is headquartered in Fort Worth, Texas (BNSF, 2000).

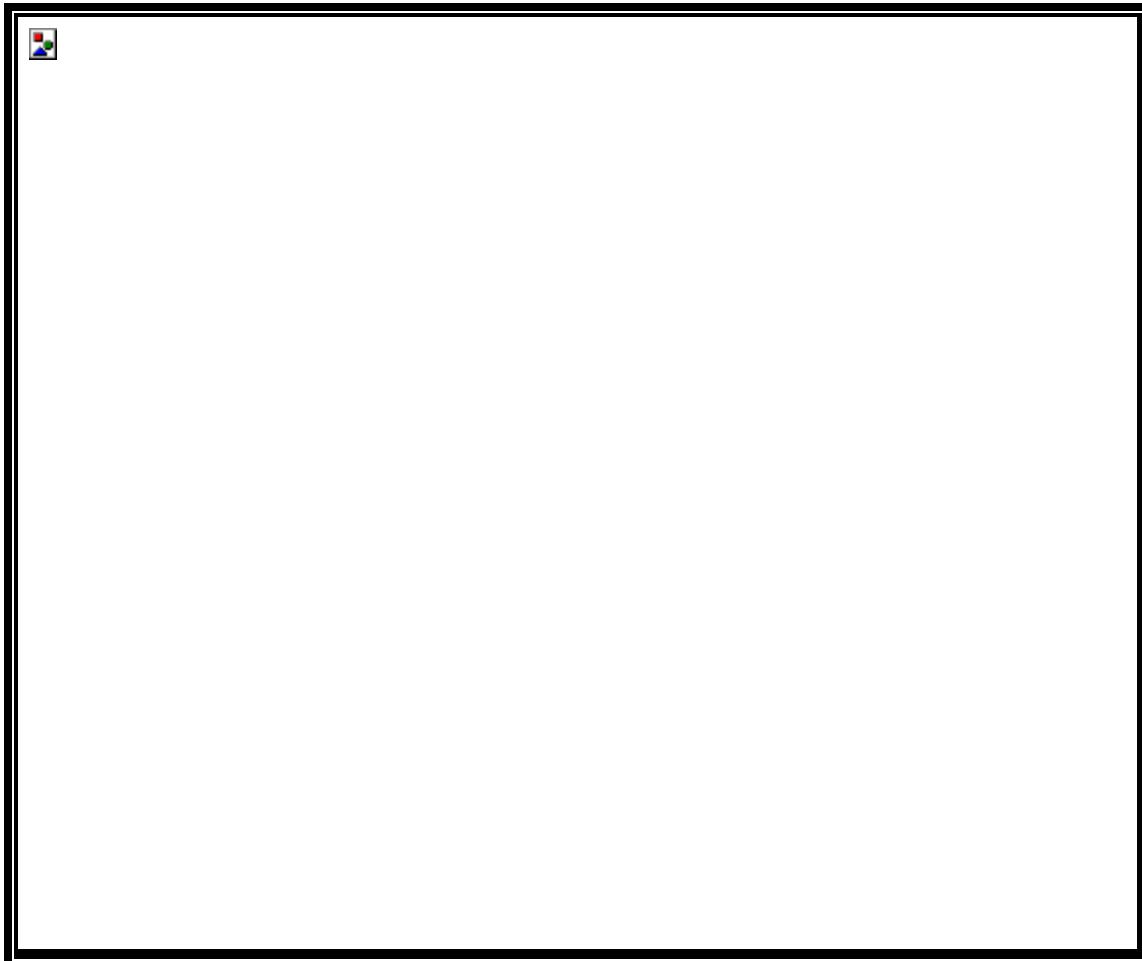


Figure 1. BNSF Railway System Map (BNSF, 2000)

BNSF was created on September 22, 1995, when Burlington Northern Inc. (parent company of Burlington Northern Railroad) and Santa Fe Pacific Corporation (parent company of the Atchison, Topeka and Santa Fe Railway) merged. In 1997 and 1998, BNSF invested over \$2 billion a year in capital investments. Since its inception, BNSF has received more than 600 new locomotives. With these new locomotives in its roster,

25-percent of BNSF's locomotive fleet will be less than five years old (Hillis, 1999:10).

Table 1 provides a snapshot of BNSF operations.

Table 1. BNSF Facts Snapshot (BNSF, 2000)

<b>BNSF</b>	
<b>Route Miles</b>	<b>33,500</b>
<b>Number of Employees</b>	<b>44,500</b>
<b>Locomotives</b>	<b>5,000</b>
<b>Freight Cars in Service</b>	<b>90,000</b>

Union Pacific Railroad is an operating subsidiary of Union Pacific Corporation. It operates primarily in the western two-thirds of the United States (see Figure 2). The system serves 23 states, linking every major West Coast and Gulf Coast port. It also serves four major gateways to the east: Chicago, St. Louis, Memphis and New Orleans. Additionally, UP is the primary rail connection between the United States and Mexico, and interchanges traffic with the Canadian rail system (UPRR, 2000). Union Pacific Railroad has one of the most diversified commodity mixes in the industry. Commodities include: chemicals, coal, food and food products, grain and grain products, forest products, intermodal, metals and minerals, automobiles and parts, as well as heavy construction and military vehicles.

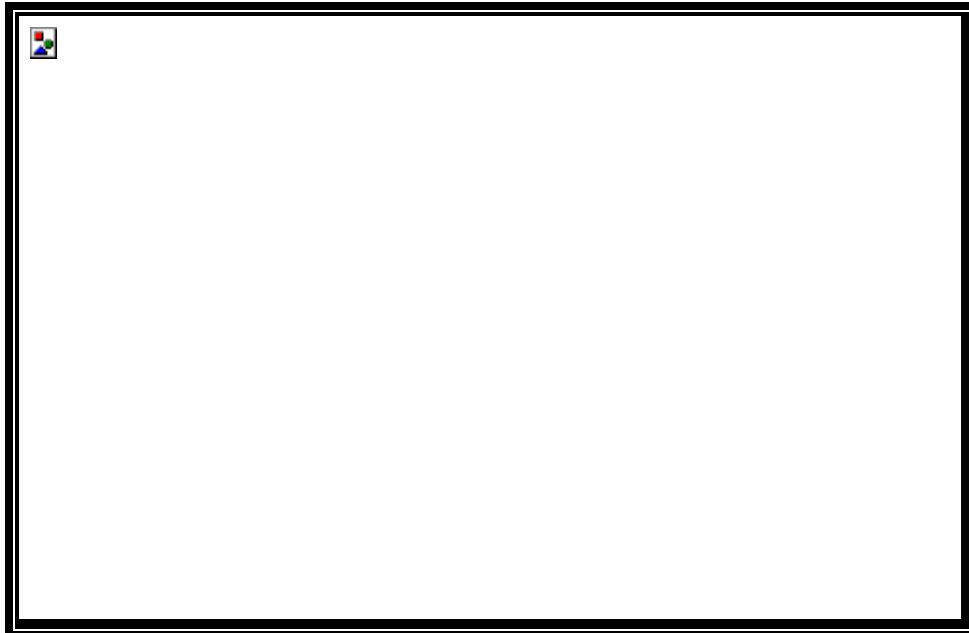


Figure 2. Union Pacific Railroad System Map (UPRR, 2000)

The current Union Pacific Railroad was formed in 1996 when Union Pacific Railroad merged with San Francisco, California, based Southern Pacific Railroad (SP). The addition of SP provided an additional 13,000 miles of track throughout the West and Northwestern United States. More importantly, it provided an additional 3,900 miles of track in the profitable California corridor, with access to the major intermodal facilities at Long Beach, Oakland, Stockton, and Los Angeles, California (Hillis, 1999:11). Table 2 provides a snapshot of UP operations.

Table 2. Union Pacific Facts Snapshot (UPRR, 2000)

<b>UP</b>	
<b>Route Miles</b>	<b>33,705</b>
<b>Number of Employees</b>	<b>52,523</b>
<b>Locomotives</b>	<b>6,913</b>
<b>Freight Cars in Service</b>	<b>155,308</b>

CSXT is the rail transportation unit of CSX Corporation; an international transportation company with interests in rail, container shipping, intermodal, trucking, barge and contract logistics services. CSXT owns and operates the largest railroad network on the East Coast (see Figure 3). Its nearly 23,000-route mile network serves 24 states, the District of Columbia and Montreal, Canada. Additionally, CSXT serves 29 of the nation's top 53 metropolitan markets and more than 50 ocean, river, and lake ports, more than any other railroad (CSXT, 2000). CSXT is responsible for moving more than one-third of all automobiles produced in the United States and serves 38 automobile

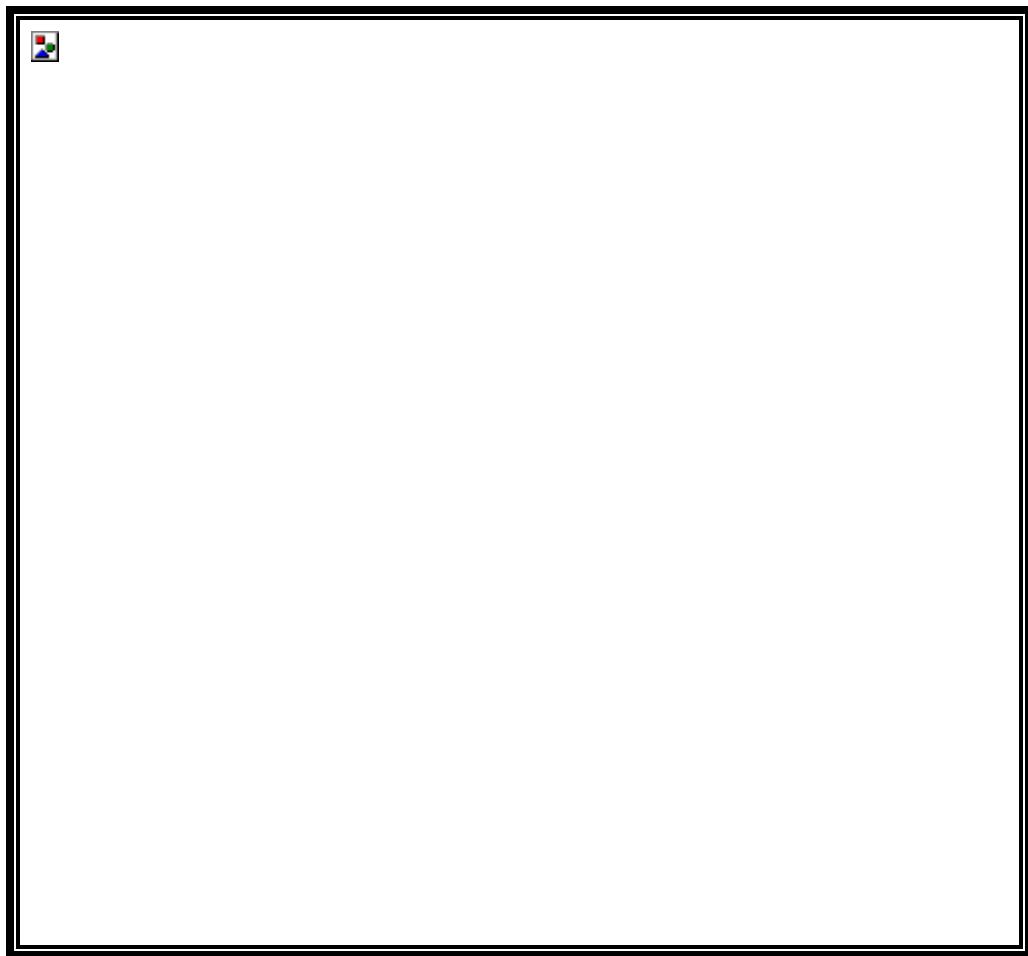


Figure 3. CSXT System Map (CSXT, 2000)

distribution centers across the United States. CSXT also serves more than 125 bulk intermodal distribution terminals and rail-to-truck transload facilities as well as 129 active coal mines and 110 coal-fired power plants and cogeneration facilities (CSXT, 2000).

CSX corporation was formed in November 1980, by the merger of two major eastern railroads: Chessie System and Seaboard Coast Line. The merged railroads began operating as CSX Transportation Inc. in 1986 (CSXT, 2000). In 1998, CSXT received permission from the Surface Transportation Board to operate a large portion of the assets and routes of Conrail, further expanding the railroad's reach in the eastern United States. Table 3 provides a snapshot of current CSXT operations.

Table 3. CSXT Facts Snapshot (CSXT, 2000)

<b>CSXT</b>	
<b>Route Miles</b>	<b>22,700</b>
<b>Number of Employees</b>	<b>34,500</b>
<b>Locomotives</b>	<b>3,646</b>
<b>Freight Cars in Service</b>	<b>121,500</b>

The Norfolk Southern Railway Company operates the second largest railroad network on the East Coast (see Figure 4). NS has nearly 22,000 route miles in 22 states, the District of Columbia and the Province of Ontario, Canada. NS services the majority of the eastern United States to include most major cities and ports along the Eastern seaboard, the Great Lakes and Gulf of Mexico.

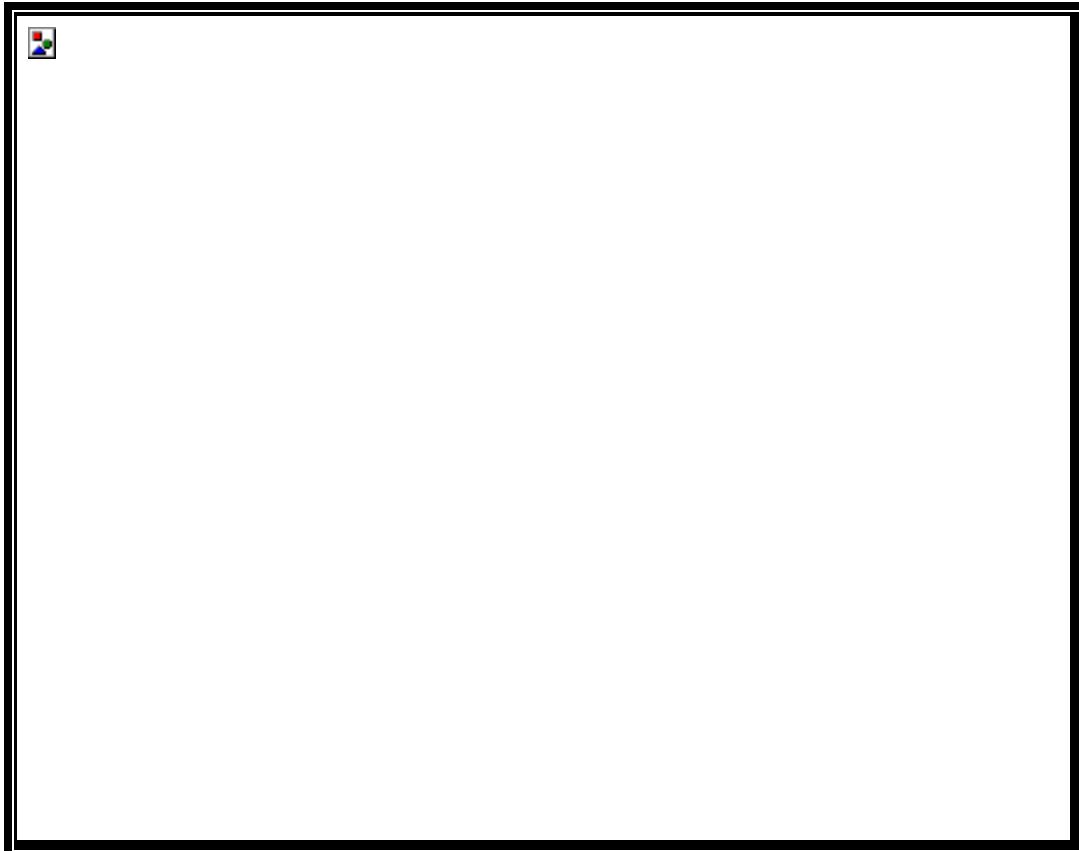


Figure 4. Norfolk Southern Railway System Map (Norfolk Southern, 2000)

NS is a Virginia-based holding company with headquarters in Norfolk, Virginia. NS was formed in June 1982 with the consolidation of Norfolk and Western Railway and Southern Railway. In 1998, NS received permission from the Surface Transportation Board to operate a large portion of the assets and routes of Conrail, expanding the railroad's reach into the Northeast (Norfolk Southern, 2000). Currently, NS owns a 58-percent economic interest in Conrail. Norfolk Southern's primary sources of transportation revenue are coal, paper and forest products, agricultural products, chemicals, automotive part and finished vehicles, intermodal trailers and containers, as

well as heavy construction and military equipment and vehicles (Norfolk Southern, 2000). Table 4 provides a snapshot of Norfolk Southern's operations.

Table 4. Norfolk Southern Facts Snapshot (Norfolk Southern, 2000)

<b>NS</b>	
<b>Route Miles</b>	<b>21,900</b>
<b>Number of Employees</b>	<b>24,300</b>
<b>Locomotives</b>	<b>3,500</b>
<b>Freight Cars in Service</b>	<b>126,000</b>

The Kansas City Southern Railway Company operates over 2,700 track miles in 12 central and southeastern states and Mexico's major industrial and population centers. Through market alliances with I&M Rail Link and Canadian National, the KCSR rail network extends north into Canada.

KCSR was founded in 1887 with the vision of providing the most direct salt-water access from the Midwest. Today, KCSR has the shortest route between Kansas City and the Gulf of Mexico, serving the ports of Port Arthur, Texas; New Orleans and West Lake Charles, Louisiana; and Gulfport, Mississippi (KCSR, 2000). KCSR transports a diverse mix of commodities to include: paper and forest products, agricultural products, chemicals, automotive parts, intermodal containers and large farming, construction and military equipment. KCSR has connections with all other major rail carriers to include coordinated operations with the other entities that comprise NAFTA. KCSR is headquartered in Kansas City, Missouri. Table 5 provides a snapshot of KCSR operations

Table 5. KCSR Facts Snapshot (KCSR, 2000)

<b>KCSR</b>	
<b>Route Miles</b>	<b>2,756</b>
<b>Number of Employees</b>	<b>2,888</b>
<b>Locomotives</b>	<b>434</b>
<b>Freight Cars in Service</b>	<b>14,733</b>

Representative Militarily Useful Flatcars

During 1998, the North American railroad freight car-building industry delivered 75,685 new cars. These deliveries represented many classes of railcars for a multitude of transportation missions, ranging from boxcars for transporting automotive parts, to the newest articulated-well cars designed for double and triple-stack intermodal container operations (Hillis, 1999:17).

Due to the size (width/length) and weight of many military wheeled/tracked vehicles, only certain types of commercially available railcars can be used to support Army transportation requirements. To be considered militarily useful, commercially available general-purpose flatcars need to meet several important requirements. First, they must have nailable decks and/or chain-tiedown assemblies that will permit vehicles to be secured to their decks during transportation. Secondly, they must be capable of supporting the concentrated weights of large tracked vehicles like the M1 tank and M88 recovery vehicle. Finally, they must be wide enough to accommodate M1 tanks and M2 Bradley Fighting Vehicles. From a DoD perspective, the commercial industry has four types of militarily useful general-purpose flatcars, capable of transporting Army

wheeled/tracked vehicles. Each of these railcars and their general characteristics are presented below.

The HTTX railcar is a 60-foot standard level car with an all wood deck, side and end stake pockets, 38 heavy duty tie-down anchors and chain assemblies contained in channels along the sides of the car and adjacent to the center sill on each side (see Figure 5). The HTTX railcar's load capacity is 153,000 pounds and was designed to transport: military, agricultural, and large earth moving equipment (TTX Equipment, 2000).

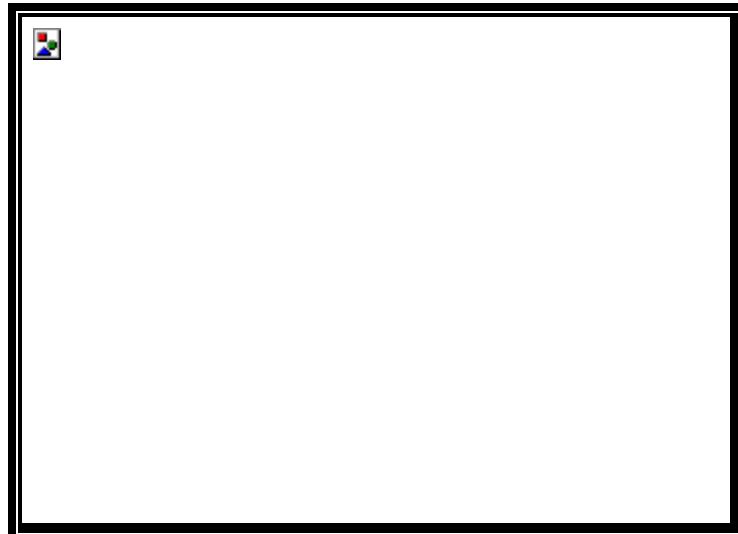


Figure 5. HTTX Railcar (TTX Equipment, 2000)

The ITTX railcar is an 89'- 4" standard level car equipped with 62 movable and retractable ratchet type winches with 3/8" alloy chains contained in channels (see Figure 6). The ITTX railcar's load capacity is 135,000 pounds and was designed to transport: trailer tractors, agricultural machinery, large trucks and military vehicles (TTX Equipment, 2000).

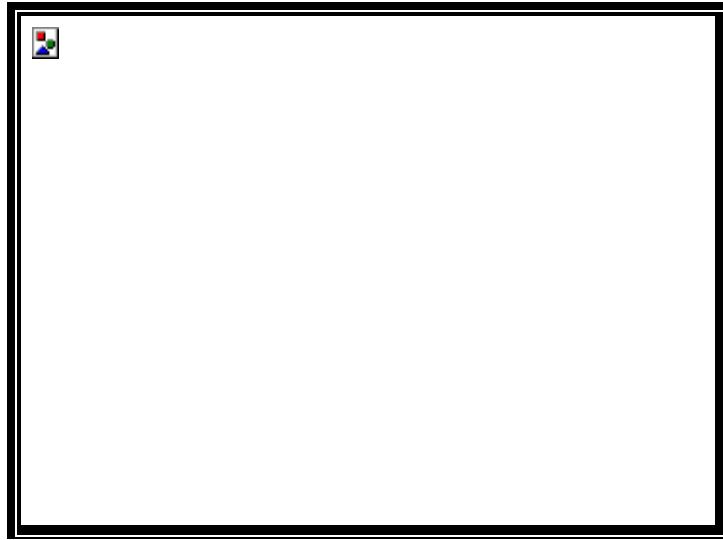


Figure 6. ITTX Railcar (TTX Equipment, 2000)

The OTTX railcar is a 60-foot chain tie-down flatcar with an all wood deck and side/end stake pockets. The car is equipped with special tie-down channels along the sides of the car and adjacent to the center sill on each side. Additionally, the car is equipped with 48 chains and moveable ratchet winches on four longitudinal channels (see Figure 7). The OTTX railcar's load capacity is about 150,000 pounds (individual cars vary somewhat) and was designed to transport: wheeled and tracked military, agricultural and construction equipment (TTX Equipment, 2000).

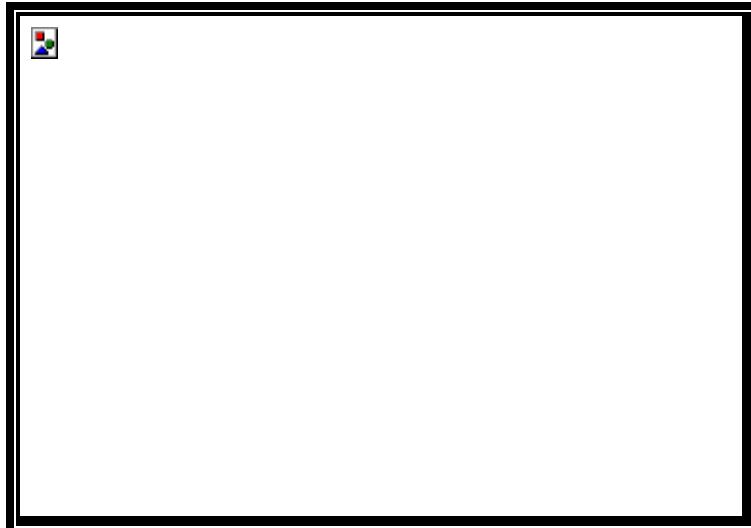


Figure 7. OTTX Railcar (TTX Equipment, 2000)

The TTDX railcar is an 89'- 0" to 89'- 4" standard level railcar equipped with steel decks and 16 moveable screw type winches, chains and bridge plates that are bolted down side guide rails (see Figure 8). The TTDX railcar's load capacity is 135,000 pounds and was designed to transport all types of roll-on roll-off vehicles used by the military and other shippers (TTX Equipment, 2000).

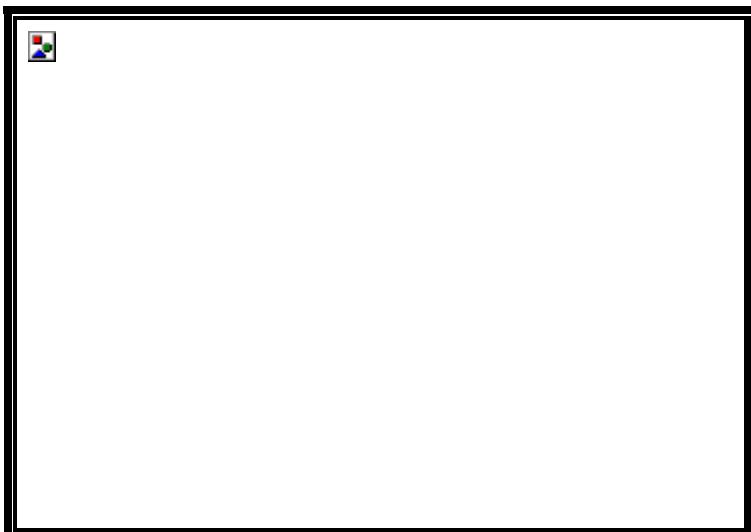


Figure 8. TTDX Railcar (TTX Equipment, 2000)

## Conclusion

The Department of Defense relies on the commercial railroad industry to move large amounts of unit equipment and cargo during times of national crisis. Most recently, during the Persian Gulf War, nearly 16,000 commercial railcars were used to mobilize, deploy and supply United States Army Units. No single commercial railroad is capable of providing the transportation support needed by the United States military. As a result, DoD utilizes five Class I railroads to provide the majority of rail support needed to move units from home station forts to seaports of embarkation.

Because of the size and weight of many of the Army's fighting vehicles, only certain types of commercially available militarily useful flatcars can be used to transport these vehicles. As the United States military further reduces its presence in overseas theaters of operation, its reliance on the commercial rail industry for transportation support from home station forts to seaports of embarkation will continue to grow.

Rail support provided by the commercial industry meets a majority of the Army's total rail transportation needs. However, the Department of Defense railcar fleet also plays a significant role in meeting Army needs, both in peacetime and wartime. The next chapter looks at the different elements of the Department of Defense's railcar industry and the types of railcars utilized by the military to transport its wheeled/tracked vehicles.

### **III. The Department of Defense Railcar Industry**

#### Introduction

Traditionally, the Department of Defense has relied on the commercial industry to furnish the majority of railcars needed for military mobilizations and deployments. However, over the past two decades, the Army has built its own fleet of railcars and locomotives to meet specific military needs, provide improved responsiveness during the first week of a mobilization and to augment the commercial rail industry during extended military mobilizations and deployments.

The DoD railcar industry is made up of three elements. The first of these, the Defense Freight Rail Inventory Fleet (DFRIF), consists primarily of heavy lift rail flatcars used to move large tracked vehicles like the M1 Abrams Main Battle Tank. The second element, the Army Strategic Mobility Program (ASMP) fleet, is a sub-category to the DFRIF and consists of medium-duty flatcars prepositioned at military installations, ready for rapid response in crisis situations. The final category, the captive fleet, consists of those railcars and locomotives used to support the day-to-day production and operating requirements of the military installations and depots to which they are assigned.

Similar to the commercial industry, the DoD railcar industry has specially designed chain-tiedown flatcars to transport its wheeled/tracked vehicles. Three series of DODX railcars are used to transport a variety of Army equipment and vehicles. DODX 40000-series flatcars transport tanks and other heavy tracked vehicles, while 41000 and 42000-series flatcars are used to transport wheeled vehicles weighing less than 80,000

pounds. These three series of flatcars can be found in both the DFRIF and ASMP railcar fleet inventories.

This chapter provides background information on the three elements of the Departments of Defense's railcar fleet, discusses the types of DODX railcars and their capabilities, and provides a brief description of the Army's fifteen power projection platforms.

### Defense Freight Railway Interchange Fleet

The first element of the DoD railcar fleet is the Army's Defense Freight Railway Interchange Fleet. This fleet of railcars is managed by the Military Traffic Management Command's, Deployment Support Command (MTMCDSC). The DFRIF is made up of railcar assets required by DoD to conduct both normal peacetime and surge deployment operations. These railcars have DODX markings, operate in revenue service for the Department of Defense and are maintained in "interchange" condition.

Interchange is a term used to describe railcars that are designed, built, and maintained to the standards and regulations established by the Association of American Railroads (AAR) and the Federal Railroad Administration (FRA). Interchange railcars are permitted to transit all railroads throughout North America on the basis of the Interchange agreement signed by all railroads and private car owners of interchange railcars (Outsourcing Study, 1999:1-8). Railcars owned by a company that does not intend on interchanging them with another railroad are not required to meet AAR standards; however, these non-interchange railcars must still comply with FRA

regulations. Except for its captive fleet, the Army maintains all of its railcars and locomotives in interchange condition.

Every day DFRIF railcars move DoD and commercial freight around the United States. MTMCDSC tracks the DFRIF fleet (including ASMP railcars) by utilizing a computer system managed by the AAR. The computer system managed by the AAR permits MTMCDSC to pinpoint the location of each of its railcars; view maintenance and inspections required by its fleet and analyze overall usage and billing of its rail assets. Use of this computer system is not free so MTMCDSC pays the AAR for use of its database.

Over the past ten years, the Army's DFRIF has been financially self-supporting. During this time period, the income generated by the Army's DFRIF railcars has been more than sufficient to pay all maintenance and management fees associated with its DFRIF railcars. For example, when a heavy equipment move (i.e. large bulldozer) is required, the shipper (an Army installation or a commercial production facility that produces Army equipment) will contract with the railroad to move the railcars. The railroad will "rent" the heavy lift railcars from MTMCDSC. The shipper pays the railroad for the move, and the railroad pays MTMCDSC 37.6 cents a mile for the use of its DFRIF railcar (The Army Rail Program 1998:3-2). In FY99, the DFRIF generated revenues of more than \$900K. So far in FY00, the DFRIF has generated nearly \$400K in total revenues (DFRIF Log, 2000). The number and types of railcars that make up the DFRIF are shown in Table 6.

Table 6. DFRIF Interchange Railcars (Gounley, 2000)

Type of Railcar	Number
Tank Cars	395
140-Ton Flatcars	566 (a)
General Purpose Flatcars	968
Special Purpose Railcars	149
Miscellaneous	47
<b>Total Railcars</b>	<b>2125</b>

(a) 315 of these cars are required to be prepositioned as part of the ASMP fleet

DFRIF tank cars are used to transport fuel under contract for the Defense Fuel Supply Center (DFSC). The 140-ton flatcars are used to transport Army heavy tanks like the M1 Abrams Main Battle Tank, and heavy engineering equipment. These heavy lift railcars represent the vast majority in either the commercial sector or DoD, capable of moving two tanks each. There are few comparable railcars in the commercial sector (The Army Rail Program 1998:3-3). DFRIF general-purpose flatcars are capable of transporting the full spectrum of military wheeled/tracked vehicles as well as a variety of intermodal shipping containers. Most special purpose flatcars are specially designed railcars used by the Pittsburgh Naval Reactor Office of the Department of Energy. The DFRIF miscellaneous railcars are a mixture of special purpose railcars to include: cabooses, boxcars, refrigeration cars, and schnabel cars. For the purpose of this research paper and Army mobilization/deployment requirements, we will be concerned only with the 140-ton flatcars and general-purpose flatcars capable of carrying Army wheeled/tracked vehicles.

### Army Strategic Mobility Program Railcars

The second element of the DoD railcar industry is the Army's ASMP railcar fleet. ASMP railcars carry DODX markings, are owned by MTMCDSC, and are counted in the total DFRIF rail fleet numbers. However, the ASMP fleet of railcars is considered a specially designated subset of the DFRIF fleet. ASMP railcars are pre-positioned at selected Army deployment installations (known as power projection platforms) to meet potential commercial railcar shortfalls during the first week of a crisis situation. Additionally, these prepositioned railcars ensure selected Army units are able to reach ports of embarkation as prescribed by deployment timelines found in MRS-05 and SDP-2. ASMP railcars fall under the operational control of Forces Command (FORSCOM) and Operations Support Command (OSC) (formerly known as Industrial Operations Command - IOC). According to an Army-wide policy, ASMP railcars will only be used for contingency deployments, with exceptions made on a case by case basis, and with final approval given by FORSCOM. The current and future inventories of ASMP flatcars will be discussed in further detail in Chapter 5 of this research paper.

### Captive Fleet

The final element of the DoD railcar industry is the captive railcar fleet. This fleet of railcars is used to support day-to-day production and operating requirements of DoD installations and depots. Just as the name "captive" infers, these railcars and locomotives do not leave the confines of their home installation or depot. The captive fleet of flatcars and boxcars stationed at OSC installations/depots are an integral part of

the ammunition production and storage process. Additionally, the captive fleet locomotives at FORSCOM and MTMC installations provide motive power for the movement and positioning of railcars when required for training, exercise, and real world rail movements (The Army Rail Program, 1998:3-7). This fleet of railcars does not play a role in the transportation of Army wheeled/tracked vehicles from home unit locations to ports of embarkation. Table 7 depicts the number and type of railcars in the DoD captive fleet.

Table 7. Captive Fleet Railcar Composition (The Army Rail Program, 1998/3-8)

Type of Railcar	Number
Tank Cars	38
Hopper Cars	65
Side Dumps	5
Gondolas	22
Flatcars	98
Boxcars	933
<b>Total</b>	<b>1161</b>

#### Representative DODX General-Purpose Flatcars

The Department of Defense relies heavily on the commercial rail industry to furnish large numbers of general-purpose flatcars to support Army unit moves during deployment exercises and contingencies. In addition to these commercial railcars, the Army uses general-purpose flatcars from its DFRIF and ASMP fleets to provide improved responsiveness during the first week of a mobilization and to augment the commercial rail industry during extended military mobilizations and deployments.

Department of Defense railcars assigned to the DFRIF and ASMP fleets are designated as “DODX” series railcars. The Army employs three primary series of DODX flatcars to transport unit equipment and wheeled/tracked vehicles from home station forts to ports of embarkation during mobilization and deployment activities. Each of the three series of DODX flatcars is discussed in the upcoming sections. Table 8 summarizes the important characteristics of each DODX series chain-tiedown flatcar.

Table 8. DODX Series Flatcars (MIL-STD-1366D, 1998:18)

DODX Flatcar	Cargo Load Limit	Length	Number Available	Axles	Years Built	Notes
40000-series	150 tons	68-ft	566	6	1980-1985	Heavy-Duty Chain-Tiedown
41000-series	101-103 tons	68-ft	236	4	1994-1996	Chain-Tiedown
42000-series	94 tons	89-ft	334	4	1994-1997	Chain-Tiedown

DODX 40000-series heavy-duty chain-tiedown flatcars are primarily used for moving tanks and other heavy tracked vehicles. The Army purchased these heavy-duty flatcars during the 1980s to replace Korean War-vintage heavy-duty flatcars that were capable of carrying two M48 or M60 tanks, but not two M-1 tanks. Today, few flatcars owned by the commercial rail industry are capable of carrying tanks, and practically no commercial flatcar can carry two M-1 tanks (Dorfman, 1997:15). Most DODX 40000-series heavy-duty flatcars “float” between Army installations, providing heavy lift rail transportation for units preparing to deploy on training missions and real-world contingencies.

DODX 41000 and 42000-series chain-tiedown flatcars are similar to the chain-tiedown flatcars found in today’s commercial railcar industry. The primary purpose of

DODX 41000 and 42000-series flatcars is to carry wheeled vehicles weighing less than 80,000lbs. However, if required, each 41000-series flatcar can carry one M1 tank.

Currently, all DODX 41000 and 42000-series medium-duty chain-tiedown flatcars are prepositioned at key military installations known as power projection platforms.

The DODX 41000 and 42000-series flatcars were purchased in the mid-1990s to provide the Army with a capability to respond more rapidly during crisis situations and contingencies. If a crisis were to occur, it would take approximately five to seven days to collect the required numbers of commercial flatcars on military installations to begin the out-loading of military equipment (Dorfman, 1999:18). These prepositioned DODX 41000 and 42000-series medium-duty flatcars ensure the Army can respond during the first week of a mobilization, when the commercial rail industry can't. Besides rapid response in support of mobilization, these medium-duty railcars will also be used to offset commercial railcar shortages in subsequent weeks of a mobilization.

In the past, the only time DODX 41000 and 42000-series flatcars were utilized was during exercises and real world contingencies. As a result, these medium-duty flatcars sat idle for very long periods of time at their “prepositioned” installations. These long lay-ups have resulted in railcar maintenance problems. “When a flatcar sits still for months and months, its internal brake valve parts are subject to sticking and its axle lubrication may become substandard, rendering it unusable” (Dorfman, 1999:19). Currently, MTMC is looking at a program that will enable these flatcars to be exercised one or more times each year to prevent seize-up and deterioration of railcar components. This periodic use will ensure DODX 41000 and 42000-series flatcars are prepared for rapid response in times of crisis.

## DoD Power Projection Bases

To rapidly respond in a crisis situation, the Army has a requirement to prepositioned 1056 ASMP heavy and medium-duty chain-tiedown flatcars at 15 power projection platforms. DODX 40000/41000/42000-series flatcars are prepositioned at the 15 power projection platforms to ensure selected Army units are able to quickly reach ports of embarkation and to meet any potential commercial railcar shortfalls during later stages of a crisis deployment. As previously mentioned, deployment timelines for Army units are prescribed in MRS-05 and MTMC's SDP-2. Figure 9 depicts the 15 Army and four Marine Corps power projection platforms.

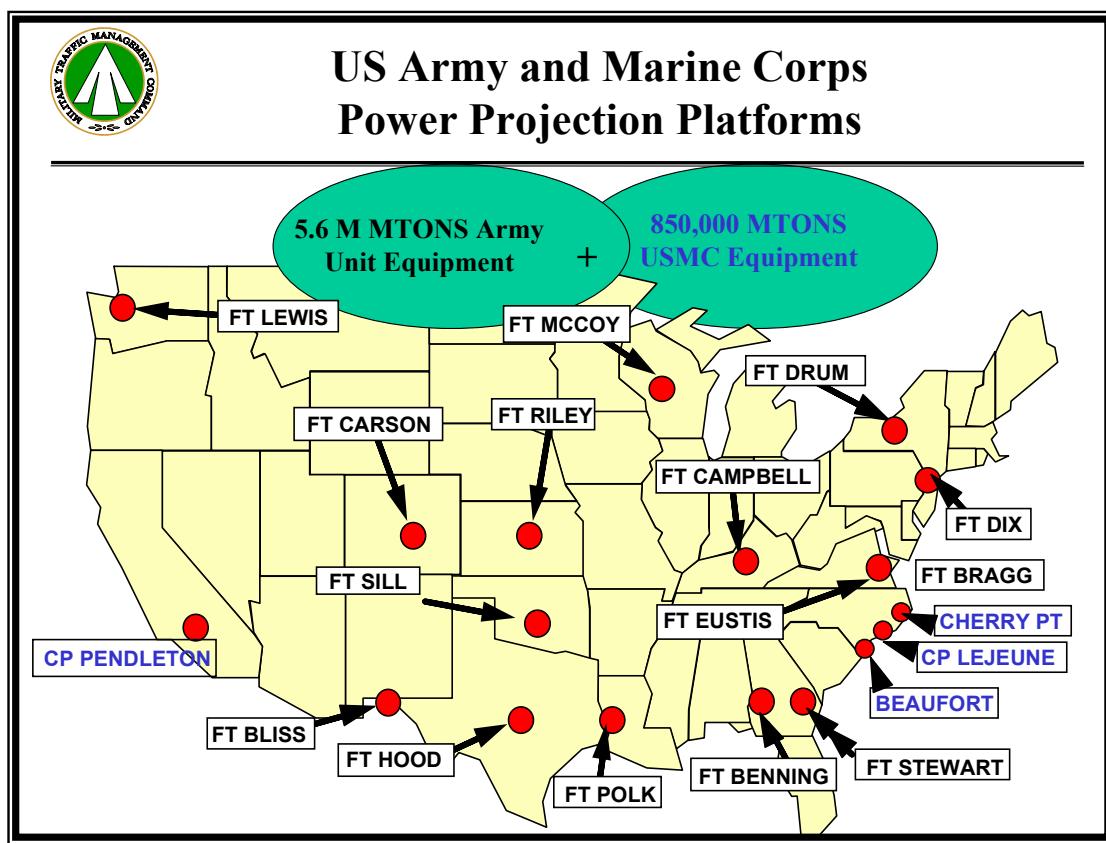


Figure 9. DoD Power Projection Platforms (Smith, 2000)

Nearly 80 percent of unit Army equipment needed to support the two near-simultaneous MTW concept will originate from these 15 power projection platforms. To support two MTWs, a total of 7 million tons (MTONS) of cargo will move across the United States from unit forts to ports, to be loaded on common user sealift provided by Military Sealift Command (MSC). The total requirement for the Army is 5.6 MTONS, while the total requirement for the Marine Corps is 850,000 MTONS. The remaining services surface shipping requirements are less than 300,000 MTONS (MTMC, 2000).

### Conclusion

The Department of Defense relies heavily on its fleet of DODX railcars to support unit moves in preparation for exercises and contingencies. Each element of the DoD railcar fleet plays a significant role in the overall success of Army units' mobilization and deployment requirements. Without the DFRIF's capacity to move main battle tanks to ports of embarkation and the prepositioned ASMP fleets rapid response capability, the Army would be hard pressed to mobilize and deploy within prescribed timelines as stated in Department of Defense directives.

The next chapter looks at the specific commercial and DoD flatcar requirements needed to support Army mobilization and deployment efforts in support of two near-simultaneous MTWs. Mobilization and deployment requirements found in the DoD's Mobility Requirements Study 2005 and the Army's Surface Distribution Plan #2 will be presented.

## **IV. Department of Defense Flatcar Requirements**

### Introduction

Following the collapse of the Berlin Wall, the break up of the Soviet Union, and the end of the Cold War, the United States faced a changing world environment. As a result of this changing environment, the United States developed a new military strategy. The old strategy that focused on a major European land war, pitting the United States and its allies against the former Warsaw Pact nations, crumbled over night like the Berlin Wall. The new strategy that emerged from the old strategy's ruins was that of dealing with regional conflicts. This new strategy dictated that the United States military be capable of responding quickly to two near-simultaneous MTWs.

This chapter begins with a historical look at the development of DoD's Mobility Requirements Study 2005 and explains the two near-simultaneous Major Theater War (MTW) concept. In addition, a brief discussion of the significance of the Army's Surface Distribution Plan #2 (SDP-2) will be provided. Finally, strategic rail mobilization requirements found in MRS-05 and SDP-2 will be presented.

### Mobility Requirements Study 2005 Defined

In 1991, as a result of the United States' new military strategy, Congress tasked DoD through the National Defense Authorization Act, to conduct a study of the military's future strategic mobility requirements (Hancock and Lee, 1998:75). This study, which was accomplished in 1992, became known as the Mobility Requirements Study (MRS). The purpose of this study was to determine if the United States military had the strategic

mobility capability to quickly respond to an overseas contingency with sufficient numbers of soldiers and equipment. This mobility requirements study provided a baseline for DoD programming of strategic mobility forces and permitted a comprehensive review of US strategic mobility requirements for the 1999 timeframe (MRS BURU, 1995:I-1).

Following the release of the MRS in 1993, significant military force structure changes occurred that presented DoD with the need to reexamine the strategic mobility force assumptions previously used in MRS. In April 1994, the Deputy Secretary of Defense signed the memorandum, “Mobility Requirements Study Bottom-Up Review Update,” tasking the Joint Staff to once again conduct an analysis of the military’s strategic mobility requirements. The results of this review were published in 1995 and became known as Mobility Requirements Study, Bottom-Up Review Update (MRS BURU).

The purpose of this study was to validate existing mobility requirements and update those requirements that had changed as a result of warfighting enhancements, changes in overall force structure, acquisition delays, and other changes in the flag merchant fleet (MRS BURU, 1995:ES-1). This study examined the mobility resources and force structure projected for Fiscal Year (FY) 2001 by looking at the FY 1995 Presidential Budget (PB).

One of the most significant differences between MRS BURU and the MRS of 1993, was that MRS BURU examined a full range of future potential contingencies that might occur in various theaters of operation. The focus of MRS BURU was to determine intertheater strategic mobility requirements for a conventional war in four potentially

separate scenarios; MTW East, MTW West, near-simultaneous East-West, and near-simultaneous West-East (MRS BURU, 1995:ES-2).

In 1999, the Joint Staff was again tasked to conduct an analysis of the military's strategic mobility requirements. This study, which is known as the Mobility Requirements Study 2005 (MRS-05), is scheduled for final release in September 2000 (Brumbaugh, 2000). MRS-05 is being used to validate and update the previous strategic mobility requirements outlined in MRS BURU. In its analysis, MRS-05 uses the mobility resources and force structure projected for FY 2005 by looking at the FY 2000 Presidential Budget.

Similar to MRS BURU, MRS-05 bases its strategic mobility analysis on four individual conflict scenarios; MTW East, MTW West, near-simultaneous East-West, and near-simultaneous West-East. Of these four scenarios, the near simultaneous MTW options (East-West and West-East) put the largest demand on the strategic mobility system. The "East" conflict scenario is defined as a contingency that takes place in Southwest Asia (SWA) while the "West" scenario is defined as a conflict that would take place on the Korean peninsula. The next section explains how the two near-simultaneous Major Theater War concept works.

### Near-Simultaneous Major Theater Wars Explained

Initially, a conflict will erupt in either one of two possible regions (East – Southwest Asia or West – Korean peninsula), thereby necessitating the deployment of additional troops and equipment from CONUS to support troops already stationed within the particular region of conflict. The in-place troops supported by the deploying troops

would then be of sufficient strength and numbers to halt any enemy aggression until additional troops and equipment could arrive from the United States. Once all troops and equipment were in place, an offensive would begin that would drive the enemy from all occupied territories. It is assumed at this point, following the defeat of the enemy in the first region of conflict, a second (near-simultaneous) conflict would erupt in the second region. The troops and equipment already in place in this second region would then be reinforced with troops and equipment from the CONUS. These combined assets would then be expected to stop and hold enemy forces in the second region until forces from the first region of conflict could be freed to further bolster the troops and equipment in the second region of conflict. The combined forces within the second region would then be of sufficient strength and size to begin offensive operations, thereby repelling and defeating the enemy (Leatherman, 1999).

War planners have developed support plans for a variety of possibilities. The two most challenging scenarios are the near simultaneous East-West and West-East conflict scenarios. The support plans associated with each of these scenarios places different stresses on the strategic mobility system.

The West-East scenario is ultimately more challenging; however, the East-West scenario places much greater stress on the entire transportation system within the first two weeks of a dual MTW than does any of the other scenarios, because it begins with the most challenging initial surge requirement. (Leatherman, 1999)

Since the East-West conflict scenario presents the most challenges to war planners, it will be used in this research paper to determine the required number of general- purpose flatcars needed to support Army wheeled/tracked vehicle during mobilization and deployment.

## Flatcar Assets Required to Meet MRS-05

Meeting the requirements of a near-simultaneous East-West MTW scenario in MRS-05 will require significant numbers of general-purpose flatcars from both the commercial and DoD railcar fleets. Two critical periods exist during a near-simultaneous MTW scenario that require large numbers of general-purpose flatcars. The first critical period (surge operations) begins when the first MTW kicks-off. The second critical period (peak operations) occurs shortly after the second MTW has begun. To determine the number of militarily useful flatcars needed to meet MRS-05 mobilization requirements during these two critical periods, a series of analysis models/programs was run by mobility planners at USTRANSCOM, MTMC, and MTMCTEA.

USTRANSCOM ran MIDAS first to select seaports of embarkation and establish required load times at the ports. MTMCTEA then ran these results with CONUS ELIST to determine the CONUS movement times and mode selection from origin to port to meet the MIDAS-determined CONUS port load dates. To establish the railcar requirements, MTMCTEA processed those requirements that ELIST determined should move via rail through TARGET. This model loads transportation assets using dimensional and weight characteristics of each piece of equipment. TARGET determined requirements for 68-foot 140-ton cars that carry M1 tanks, bi-levels that carry roadable vehicles, container-on-flatcars that carry containerized unit equipment and chain tie-down flatcars that carry the remaining unit equipment. This analysis resulted in a daily loading requirement for each type of asset at each installation. To determine the total number of railcars required, TEA then ran a cycling analysis using standard spreadsheet capabilities. This resulted in an assessment of the numbers of railcars in use each day of the MRS scenarios. (Brumbaugh, 2000)

Figure 10 depicts the number of 60-foot equivalent flatcars required by the draft copy of MRS-05 to meet surge operations during the first critical period of a near-simultaneous MTW scenario. Figure 10 depicts two key pieces of information: the number of flatcars to be loaded at all power projection platforms and the cumulative

number of 60-foot equivalent flatcars that will be “in use” during each of the first 14 days of conflict. The largest number of “loadings” during initial surge operations occurs on day seven (1,077 flatcars). Additionally, the largest number of “in use” flatcars also occurs on day seven (4,046 flatcars).

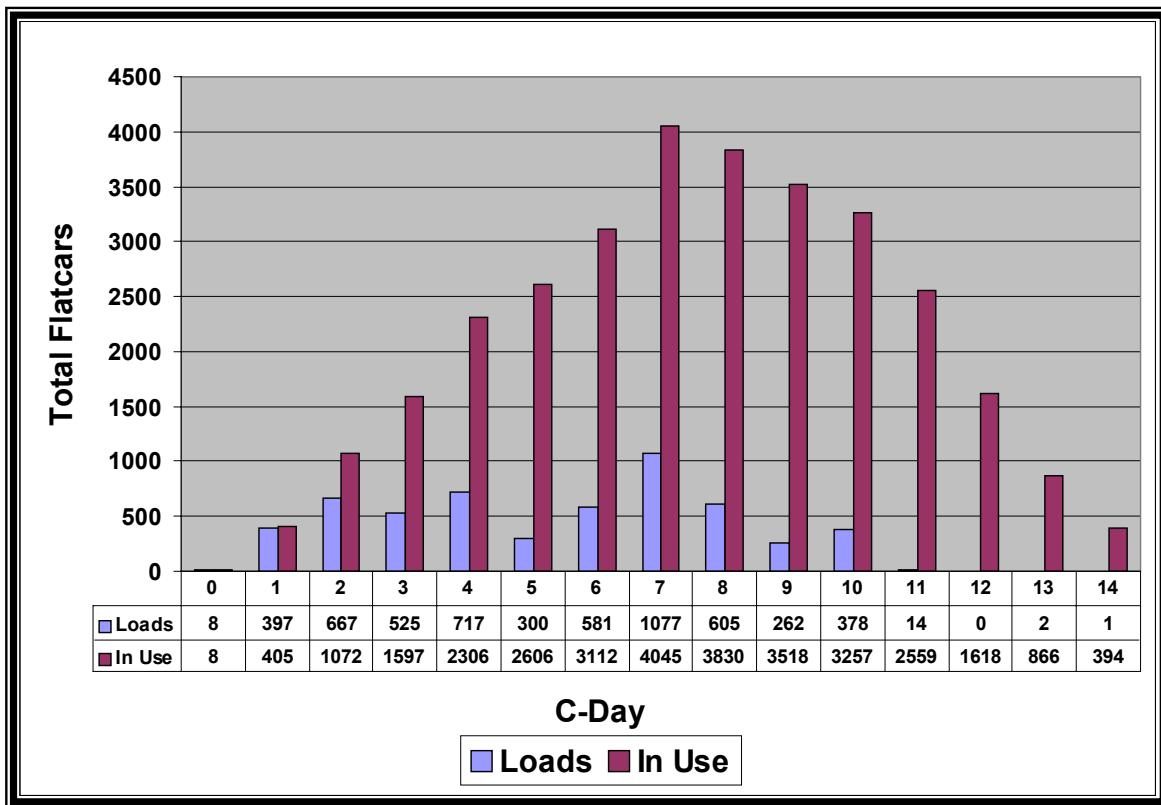


Figure 10. MRS-05 60-Foot Flatcar Surge Requirements (Brumbaugh, 2000)

Commercial and DoD 89-foot flatcars are included in Figure 10 (one 89-foot flatcar equates to 1.5 60-foot flatcar equivalents). Additionally, Figure 10 assumes commercial flatcars will arrive at the appropriate power projection platforms within one week of notification. According to a manager at Union Pacific, its railcars could be moved from any point in its system to any other point within four days (Snodgrass,

1999). A sales executive at CSX echoed these estimates by saying, "In an emergency situation we would have to activate any needed assets into position to fill wartime requirements. We would do so by routing empty cars to the needed points and even emptying loaded cars to expedite them to the points necessary for loading" (Hicks, 1999). Until commercial flatcars could arrive at power projection platforms to begin loading, prepositioned DODX 41000/42000-series flatcars belonging to DoD's ASMP fleet of railcars will be used to load and transport Army wheeled/tracked vehicles.

The second critical period (peak operations) occurs shortly after the second MTW has begun. During this second critical period, general-purpose flatcars will be used in two primary roles; to deploy Army wheeled/tracked vehicles in support of the second MTW and to simultaneously redeploy Army wheeled/tracked vehicles following the halting phase of the first MTW. This combination of deployment (MTW #2) and redeployment (MTW #1) will severely strain the commercial and DoD general-purpose flatcar fleets.

Figure 11 depicts the number of 60-foot equivalent flatcars required by MRS-05 to meet peak operations during the second critical period of a near-simultaneous MTW scenario. Figure 11 shows the number of flatcars to be loaded at all power projection platforms and the cumulative number of 60-foot equivalent flatcars that will be "in use" from day 90 through day 104 of the dual MTW scenario in MRS-05. The peak requirement for flatcar "loading" during this second critical period occurs on day 96 (1,166 flatcars) while the peak day for flatcars "in use" occurs on day 98 (8,239 flatcars).

Similar to Figure 10, commercial and DoD 89-foot flatcars are included in

Figure 11 totals (one 89-foot flatcar equates to 1.5 60-foot flatcar equivalents). It is assumed at this point in a dual MTW scenario that the commercial rail industry will provide all available militarily useful flatcars to support mobilization and deployment operation from the Army's 15 power projection platforms.

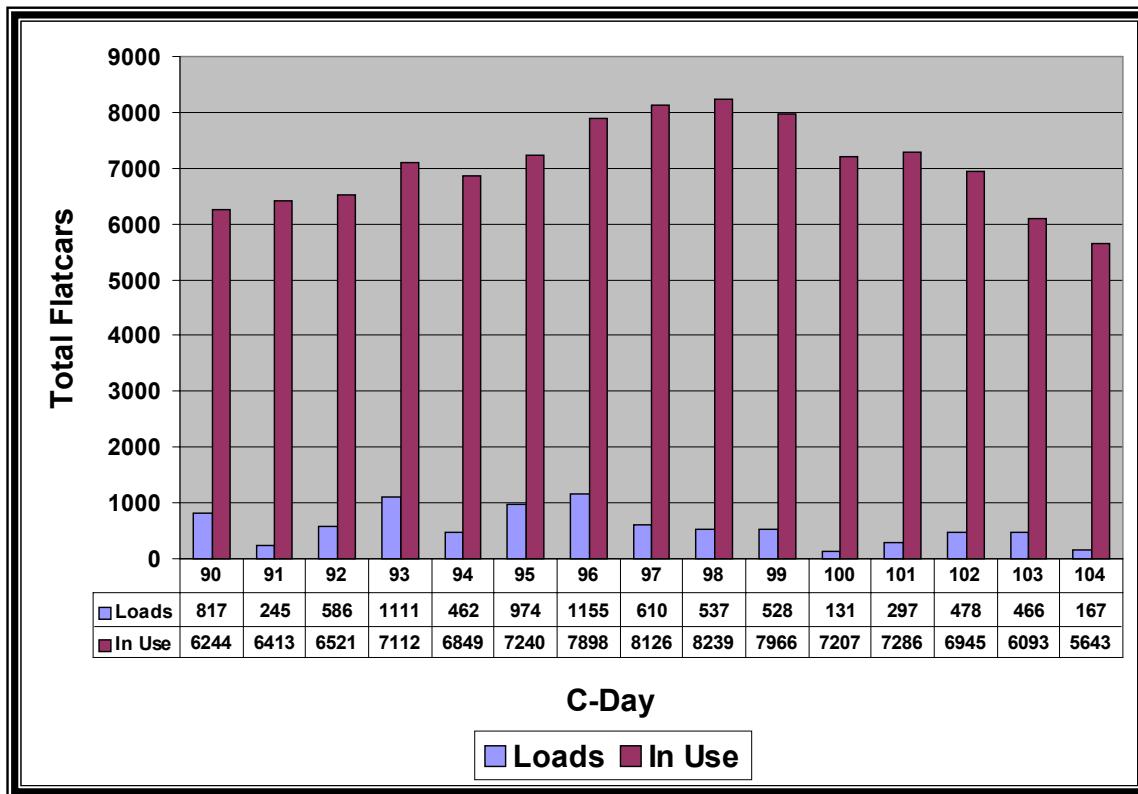


Figure 11. MRS-05 60-Foot Flatcar Peak Requirements (Brumbaugh, 2000)

#### Surface Distribution Plan #2 Defined

The Military Traffic Management Command (MTMC) has a global traffic management mission during peace, Military Operations Other Than War (MOOTW) and war (SDP-2, 1999:1). As the primary director of global traffic management, MTMC is responsible for determining the assets required to deploy/sustain both military forces and

equipment from CONUS points of origin to aerial/seaports of embarkation (APOE/SPOE). In order to enhance preparation and advance coordination for deployment among MTMC, supported units, and the transportation industry, MTMC developed a Surface Distribution Plan (SDP).

The current SDP employed by MTMC is SDP-2. This SDP is based on planning factors required to support a dual Major Theater War (MTW) scenario. SDP-2 covers the first 120 days of a dual MTW scenario by breaking down the major mobilization and deployment requirements into 17 one-week periods. The plan focuses on the requirements of the Army's 15 Power Projection platforms, selected Marine bases, and the major Operations Support Command depots. All information contained in SDP-2 is for planning purposes only. The primary benefit of SDP-2 is that it permits determinations to be made as to whether its stated requirements are supportable by commercial industry carriers, installations, depots, and APOE/SPOE (SDP-2, 1999:1).

Annex A of SDP-2 is titled "Force Deployment," and depicts the unit movement requirements for the first 120 days in the execution of a major force deployment. The requirements for Annex A were generated from a transportation feasible Time-Phased Force Deployment Data (TPFDD) for a dual MTW. The TPFDD data was modeled by STRADS, MTMC's system of record for deliberate and strategic planning of CONUS movements. STRADS utilizes TPFDD requirements to determine ports of embarkation (POE), modes of travel to the port of embarkation (i.e. rail, truck and/or container) and establishes Available to Load Dates (ALD) at the POE (SDP-2, 1999:1).

### Flatcar Assets Required to Meet SDP-2

Figure 12 depicts the number of 60-foot equivalent flatcars and DODX 40000-series heavy-duty chain-tiedown flatcars required to support the mobilization and deployment requirements of a dual MTW scenario as stated in MTMC's SDP-2. Figure 12 further divides the requirements for 60-foot equivalent flatcars and DODX 40000-series flatcars into 17 one-week periods. The requirements depicted in this table are for the Army's 15 Power Projection Platforms and 4 Marine bases. Commercial and DoD 89-foot and 60-foot flatcars are included in Figure 12 (one 89-foot flatcar equates to 1.5 60-foot flatcar equivalents).

According to SDP-2, the 60-foot equivalent flatcar requirements of Figure 12 will be filled primarily with general-purpose militarily useful flatcars belonging to the commercial rail industry. Flatcars assigned to the DoD's prepositioned ASMP fleet will primarily be used to fill surge requirements during the first week of a mobilization and to offset other commercial flatcar shortfalls that might occur in subsequent weeks of a mobilization.

DODX 40000-series heavy-duty flatcars will primarily be used to transport heavy tracked vehicles such as the M1 tank and M88 recovery vehicle. These DODX 40000-series flatcars are capable of carrying two M1 tanks at one time. The commercial industry on the other hand has very few heavy-duty flatcars that can carry one M1 tank and practically no flatcars that can carry two M1 tanks. For this reason, DODX 40000-

series railcars will be used to move the Army's M1 tanks and M88 recovery vehicles in support of any mobilization requirements.

Currently, the DoD DFRIF fleet had 566 DODX 40000-series flatcars in its inventory. In accordance with the Army Strategic Mobility Program, 315 of these flatcars are prepositioned at the Army's Power Projection Platforms and several Marine Corps Bases, to meet initial surge requirements during a dual MTW scenario.

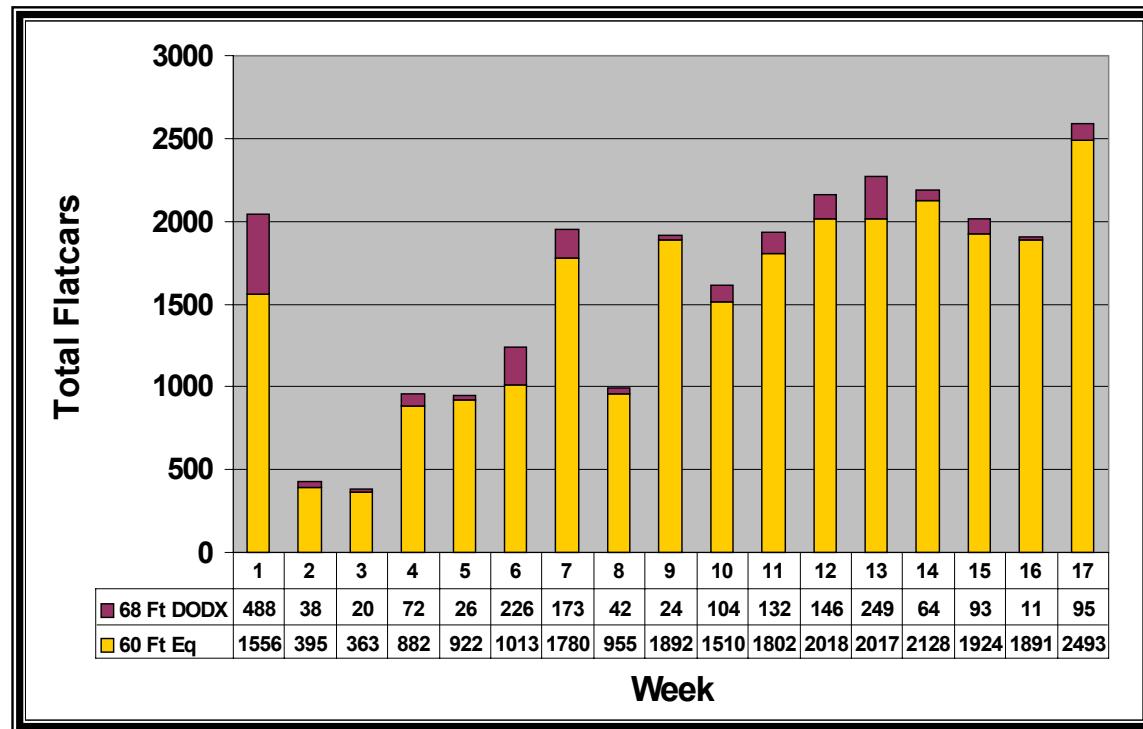


Figure 12. Total Flatcars Required by SDP-2 (SDP-2, 2000)

Figure 12 depicts an initial surge requirement of 488 DODX 40000-series flatcars and 1668 60-foot equivalent flatcars. Following an initial surge to meet mobilization requirements, the required number of flatcars remains relatively low until week 7. In week 7, flatcar requirements increase to 178 DODX 40000-series flatcars and 1780 60-

foot equivalent flatcars. Following the start of a second MTW, the requirements for militarily useful flatcars will once again increase. Between weeks 12 and 14, nearly 6,000 flatcars will be required to help transport equipment and forces deploying to MTW #2, while at the same time, redeploying equipment and troops from MTW #1. The peak week for flatcars in SDP-2 occurs in week 17 when 96 DODX 40000-series flatcars and 2,493 60-foot equivalent flatcars will be required to meet SDP-2's dual MTW scenario.

In order to maximize a limited number of militarily useful flatcars in the commercial industry, flatcars used to support SDP-2's dual MTW concept will be cycled between Army home station units and ports of embarkation. Because of the large rail distances required to transport vehicles from the East/West coast to West/East coast, a limited number of flatcar cycle periods will be available for commercial and DoD flatcar assets.

According to planners at MTMCTEA, the longest rail travel times occur between power projection platforms on the East/West coast and ports of embarkation on the West/East coast (i.e. Ft Stewart, GA to Oakland, CA or Camp Pendleton, CA to Charleston, SC). MTMCTEA's Logistics Handbook for Strategic Mobility Planning plans rail travel times based on unit trains averaging 22 mph, for a distance of 528 miles per day (MTMCTEA, 1997). Based on this information, nearly 14 days would be required to cycle flatcars in a worse case scenario between home station units on one coast and ports of embarkation on the other coast. The 14 travel days would account for home station upload (1 day), rail transportation time (6 days), equipment offload/upload at port of embarkation (2 days), and return trip to home unit (6 days) (Brumbaugh, 2000). Based on a total requirement of 27,544 flatcars (25,541 60-foot equivalent and 2003

DODX 40000-series flatcars) from Figure 12, it is estimated that 3,193 militarily useful flatcars would be required to cycle 8 times (120 days/15 days per cycle) in order to meet the dual MTW requirements of MTMC's SDP-2. This is the absolute minimum number of flatcars and does not take into account potential maintenance problems that might be associated with a commercial fleet of railcars that is on average, 30.4 years old (Meyer, 2000).

### Conclusion

Meeting the requirements of a near-simultaneous East-West MTW scenario will require significant numbers of general-purpose flatcars from both the commercial and DoD railcar fleets. During a near-simultaneous MTW scenario, two critical periods exist, that will require large numbers of militarily useful general-purpose flatcars. The first critical period (surge operations) occurs when the first MTW kicks-off. The second critical period (peak operations) occurs shortly after the second MTW has begun. During this second critical period, large numbers of flatcars will be required to deploy forces and equipment in support of the second MTW while simultaneously redeploying forces and equipment from the first MTW.

According to Figures 10, 11 and 12, the flatcar requirements of MRS-05 will put the greatest strain on the commercial and DoD inventories of general-purpose flatcars. MRS-05's initial surge requirement calls for 4,046 60-foot equivalent flatcars while it's peak operations requirement calls for 8,239 60-foot equivalent flatcars. Since MRS-05's flatcar requirements are greater than SDP-2's requirements, the general-purpose flatcar

requirements of MRS-05 will be used for all remaining comparisons in this research paper.

The next chapter begins with a description of the criteria necessary in determining whether a commercial flatcar can be considered militarily useful. Following this introduction, current and future flatcar inventories of both the commercial and DoD railcar fleets will be presented. Chapter 6 will then compare the flatcar requirements of this chapter to inventories in Chapter 5 to determine if there is or will be a shortage of militarily useful general-purpose flatcars in the commercial and/or DoD railcar fleets.

## V. Current/Future Flatcar Inventories

### Introduction

The ability of U.S. forces to change rapidly from a peacetime to a wartime force (to mobilize and deploy) is vitally important to national security. The success of this transition hinges on the ability of units to move from home stations to ports of embarkation within time frames contained in operation plans. Successful execution of these movements depends in large part, on the availability of the required transportation resources. Today's Army is heavily reliant on both commercial and DoD flatcar assets to transport wheeled/tracked vehicles from home stations to ports of embarkation to meet prescribed mobilization and deployment timelines.

This chapter begins with a look at the criteria used in determining the military usefulness of commercially available general-purpose flatcars. Next, an analysis of current and future commercially available general-purpose flatcar inventories is presented. Finally, an analysis of the current/future DoD fleet of flatcars will be presented.

### Flatcar Criteria Used in Determining Military Usefulness

Four key railcar suitability factors must be taken into consideration when determining whether commercial railcars can be considered militarily useful. First, to be considered militarily useful, commercial flatcars must be designated by the Association of American Railroads as FM or FMS railcars. The FM or FMS designator indicates that commercially available flatcars can be used for general services.

Second, commercial flatcars must have nailable decks and/or chain-tiedown assemblies that enable wheeled/tracked vehicles to be secured to their decks. If flatcars do not have nailable decks or chain-tiedowns, it will be difficult if not impossible to secure military vehicles to their decks prior to rail transportation in support of a deployment.

Third, militarily useful, flatcars cannot have obstructions or bulkheads that would prevent military vehicles from being “circus loaded”. Circus loading is a method of end loading wheeled/tracked vehicles onto rail flatcars. A vehicle is end loaded under its own power and moved forward, car to car, over spanners used between the individual flatcars on an entire train (Dorfman, 2000). This method is most often used by the military to upload its vehicles.

Finally, to be considered militarily useful, commercial flatcars must meet the length, width and load limit (weight) requirements necessary to transport military wheeled/tracked vehicles. According to a flatcar representative at MTMCTEA, up to one-half of the width of the tracks on tracked vehicles can overhang the sides of flatcars. Additionally, since most flatcars are capable of carrying only 75-percent of their rated load limit in a concentrated area, the minimum acceptable load limit for flatcar planning purposes is 133-percent of the actual military vehicle weight. This load limit factor takes into account the concentrated weights of M1 tanks (140,000 lbs.) and other large military vehicles (Dorfman, 2000). Table 9 depicts the minimum dimensional criteria necessary for commercial flatcars to transport military wheeled/tracked vehicles.

Table 9. Flatcar Dimensional Criteria For Carrying Military Vehicles (Dorfman, 1999)

Military Vehicle Type	Minimum Acceptable		
	Load Limit (lbs.)	Width (in)	Length (in)
M1 Tank	186,000	119	480
M2 Bradley Fighting Vehicle (BFV)	87,000	109	480
M998 HMMWV “Hummer”	10,000	85	240

#### Current Commercial Flatcar Inventory

In determining the capability of today's commercial flatcar fleet, two key issues must be considered: total quantity of commercial flatcars and the flexibility of these flatcars to carry various military wheeled/tracked vehicles.

Quantity: Table 10 shows that there are 9,768 militarily useful general-purpose flatcars in today's commercial fleet. MTMCTEA queried the July 1999 UMLER file using the four flatcar suitability factors discussed earlier, and generated the data collected in Table 10. The last column in Table 10 depicts the total number of militarily useful flatcars found in today's commercial fleet. This total inventory can be furthered divided into flatcars equipped with chain-tiedown devices and those that have nailable decks. The breakdown of each of these types of flatcars is shown in the “Chain Equipped” and “Nailable Deck” columns respectively. Flatcars equipped with both nailable decks and satisfactory chain-tiedown devices are included in the “Chain Equipped” column. According to MTMCTEA's flatcar representative, chain-equipped flatcars are preferable to nailable decks because securing military equipment to flatcars with nailable decks is time consuming and not conducive to rapid deployments (Dorfman, 2000). For the

purpose of this paper, militarily useful flatcars with either chain-tiedowns and/or nailable decks are considered suitable for transporting military wheeled/tracked vehicles.

Table 10. Current U.S. Commercial Flatcar Inventory (Dorfman, 2000)

Military Vehicle Transported	Number of Compatible Flatcars			Inventory Total
	Chain Equipped	Nailable Deck	Percent with Chains	
M1 Tank	495	2,511	16	3,006
M2 BFV	4,745	2,718	64	7,463
Wheeled Vehicles	6,973	2,795	71	9,768

Overall, this table shows that 9,768 militarily useful flatcars exist in today's commercial fleet. Of this total, 7,463 are capable of carrying M2 BFV's. Furthermore, 3,006 of the 9768 commercially available flatcars are capable of carrying the Army's M1 Tank.

Flexibility: Today's fleet of militarily useful commercial flatcars is flexible enough to carry the majority of Army wheeled/tracked vehicles. According to MTMCTEA's flatcar representative, over 95-percent of the commercial flatcars capable of carrying the M998 High Mobility Multipurpose Wheeled Vehicle (HMMWV) are also capable of carrying larger wheeled vehicles such as the M978 Heavy Expanded Mobility Tactical Truck (HEMTT) and small tracked vehicles such as the M113 Personnel Carrier (Dorfman, 2000).

## Future Commercial Flatcar Inventories

When determining future inventories of commercially available general-purpose flatcars, the four previously discussed flatcar suitability factors must once again be taken into consideration. Additionally, two other flatcar suitability factors must also be examined: future commercial industry purchases of militarily useful flatcars and future railcar retirements from the commercial fleet.

Future Purchases: The dramatic increase in intermodal (truck trailer and container) traffic of the past two decades is expected to increase even more in the next ten years. Large growth in the intermodal rail industry have resulted in commercial companies purchasing railcars that will provide them with a competitive edge while increasing their total revenues. Railcars capable of carrying longer truck trailers, double stacked containers and three levels of automobiles are today's revenue makers. Due to commercial purchases of these new types of railcars, the number of militarily useful flatcars purchased by the commercial industry has dropped off dramatically in the past twenty years. Since 1980, only about 200 commercial militarily useful general-purpose flatcars have been built (Dorfman, 2000). This trend looks as though it will continue. According to representatives from the commercial rail industry and MTMCTEA, only small numbers of militarily useful general-purpose flatcars will be added to the commercial fleet during the next ten years (Dorfman and Flagello, 2000). In determining future general-purpose flatcar inventories for this paper, it was assumed that no new militarily useful flatcars would be purchased by the commercial industry during the next ten years.

Retirement Schedule: The majority of today's commercial general-purpose flatcar fleet was built in the mid to late-1960s. The projected retirement of today's commercial fleet of militarily useful flatcars is a big concern. In general, flatcars built in 1963 or earlier must retire after 40 years. Flatcars built between 1964 and June 30, 1974 must retire at 40 years unless they receive a service life extension. In this case, a service life extension will extend the service life of a flatcar from 40 years to 50 years. Finally, flatcars built after June 30, 1974 are automatically eligible for a 50-year service life (Dorfman, 2000).

Future Inventories: Table 11 depicts future inventories of general-purpose flatcars in the commercial industry through 2011. The same basic procedures used to calculate current inventories of commercial general-purpose flatcars were once again used to calculate future inventories of commercial flatcars. Additionally, MTMCTEA queried the July 1999 UMLER file for railcar date-built information. By utilizing the railcar date-built information, MTMCTEA could evaluate future commercial flatcar inventories utilizing several railcar retirement scenarios. Table 11 depicts four potential flatcar retirement scenarios. Flatcar inventories depicted in Table 11 reflect all commercially available militarily useful general-purpose flatcars that have nailable decks and/or chain-tiedown equipment.

The four flatcar retirement scenarios depicted in Table 11 include: high projection, 40-year life, 30-percent extended and steady decline. The first scenario, the high projection, is based on commercially available militarily useful general-purpose flatcars staying in service until they reach their mandatory retirement age (i.e. 40 or 50 years depending on when they were built). The second scenario, 40-year life, is based on

general-purpose flatcars remaining in service until they reach the 40-year point, with no service life extensions (i.e. to 50 years) for flatcars built from 1964 through 1974. The third scenario, 30%-extended, is based on the assumption that 30-percent of all general-purpose flatcars built after 1964, will receive service life extensions through 50 years of service life. The %-decline column in each of the first three scenarios, shows the rate of decline in the total commercial flatcar inventory every three years. In the fourth scenario, the steady decline scenario, the total commercial flatcar inventory is based on a 20 percent decline in the total inventory every 3 years.

Table 11. Future Commercial General-Purpose Flatcar Inventories (Dorfman, 2000)

Year	Scenario #1 High-Life		Scenario #2 40-Year Life		Scenario #3 30%-Extended		Scenario #4 Steady Decline	
	Total Flatcars	% Decline	Total Flatcars	% Decline	Total Flatcars	% Decline	Total Flatcars	% Decline
1990	16,594	N/A	16,594	N/A	16,594	N/A	16,594	N/A
1993	15,099	9	15,099	9	15,099	9	15,099	9
1996	11,835	22	11,835	22	11,835	22	11,835	22
1999	9,768	17	9,768	12	9,768	17	9,768	17
2002	9,079	7	9,079	7	9,079	7	7,814	20
2005	8,754	4	6,814	25	7,400	9	6,250	20
2008	8,754	0	3,411	50	5,000	30	5,000	20
2011	8,754	0	2,269	33	4,200	28	4,000	20

According to MTMCTEA's flatcar representative, the commercial industries general-purpose flatcar inventory declined by 22-percent between 1993 and 1996 and by 17-percent between 1996 and 1999 (Dorfman, 2000). For this reason, 20-percent was assumed to be a reasonable declination rate for the fourth scenario.

According to MTMCTEA's flatcar representative, "Scenario #3 is the most realistic projection when considering the commercial rail industry's future flatcar inventories. While it is likely that some flatcars (probably around 30-percent) will be certified for an extended life, it is unrealistic to expect all of them to be certified (Dorfman, 2000)."

Figure 13 graphically depicts future commercial general-purpose flatcar inventories based on the most realistic scenario; 30-percent of eligible flatcars receiving a 10-year service life extension. Figure 13 indicates a steady decline in the number of commercially available general-purpose flatcars over the next 11 years. The largest percentage decrease in general-purpose flatcars occurs between 2005 and 2008. This decrease of 1,600 flatcars is equivalent to a 30-percent decline over three years.

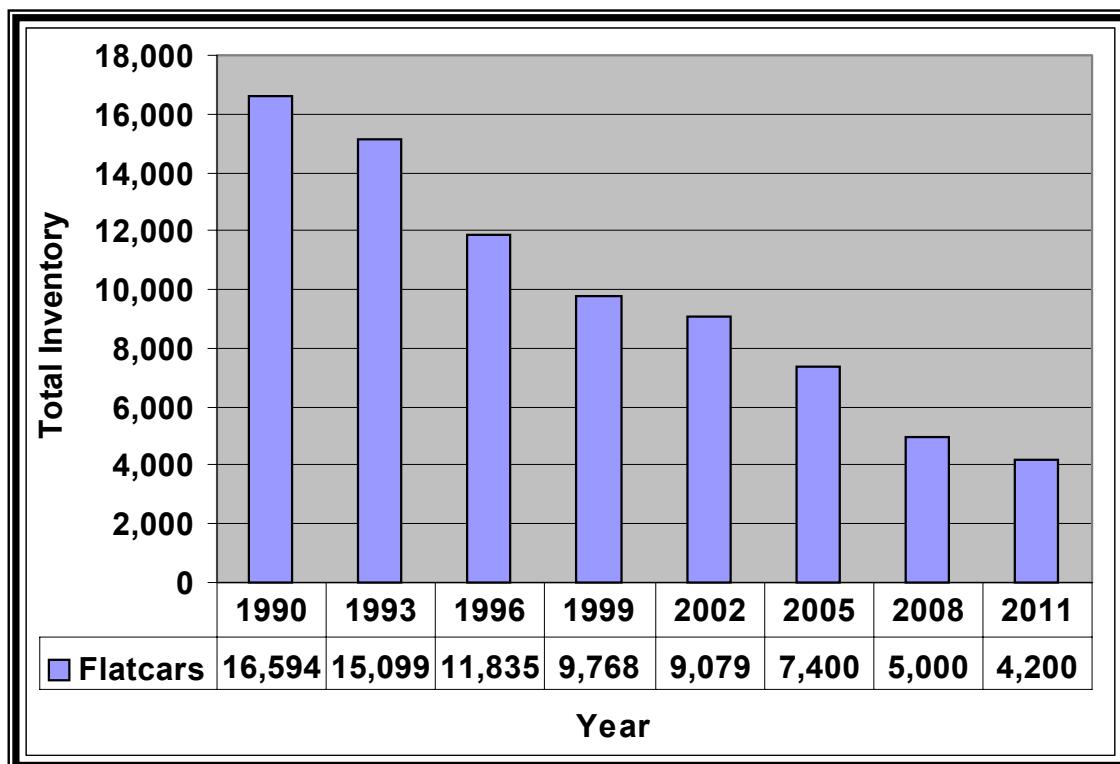


Figure 13. Future General-Purpose Flatcar Inventories (Dorfman, 2000)

Future Flexibility: As mentioned earlier, today's fleet of commercially available militarily useful flatcars is flexible enough to carry the majority of Army wheeled/tracked vehicles. According to the data collected in Table 12, the flexibility of commercial flatcar inventories will likely remain good. Table 12 assumes a conservative retirement schedule utilizing the 40-year service scenario discussed earlier. This table indicates that about 70-percent of the commercial industries chain-tiedown flatcars that can carry the HMMWV can also carry the M2 BFV. As Table 12 shows, even though the total number of militarily useful chain tiedown flatcars declines in the future, the overall proportion of M2 compatible flatcars remains nearly constant.

Table 12. Future M2 BFV Compatible Chain-Tiedown Flatcars

Year	HMMWV-Compatible Flatcars*	M2 BFV-Compatible Flatcars*	Percent M2-Compatible
1999 Inventory	6,973	4,745	68
2002 Projection	6,626	4,722	71
2005 Projection	5,212	3,673	71

\*Based on 40-year service life.

#### Department of Defense Flatcar Inventory

Traditionally, the Department of Defense has relied on the commercial industry to furnish the majority of flatcars needed for military mobilizations and deployments. However, to meet surge requirements during the first week of a contingency and to offset potential commercial flatcar shortages during subsequent weeks of a mobilization, the Department of Defense has procured and prepositioned its own fleet of railcars. This prepositioned fleet of railcars, known as the ASMP fleet, is made up of a variety of

DODX flatcars capable of transporting the full spectrum of Army wheeled/tracked vehicles. Overall, today's fleet of DODX flatcars is sufficient in number and type to offset any potential shortfalls in the commercial industry.

The lack of heavy-duty commercial flatcars capable of carrying M1 tanks was well known during the 1980's. As a result, the Department of Defense procured 566 140-ton (DODX 40000-series) flatcars in the late 1980s to provide the Army with the heavy lift it would need to support future contingency operations. Then in the mid-1990s, DoD purchased DODX 41000 and 42000-series flatcars to provide the Army with a capability to respond more rapidly during crisis situations and contingencies. When compared to the commercial fleet of flatcars, the DODX railcars are relatively young. This pool of DoD-owned flatcars will remain in service until after 2030 and could reduce the impact of any future shortage of commercial flatcars.

Table 13 shows the number, type and location of the Army's prepositioned ASMP fleet of railcars.

Table 13. Current ASMP Prepositioned Flatcars (Gounley, 2000)

Location	40000-Series		41000-Series		42000-Series		Total	
	Required	Assigned	Required	Assigned	Required	Assigned	Required	Assigned
Fort Benning	62	62		27		22	62	111
Fort Bliss			38	38	70	0	108	38
Fort Carson	85	85					85	85
Fort Campbell			14	18	220	180	234	198
Fort Hood	75	75	59	59	51	47	185	181
Fort Sill			44	44	103	0	147	44
Fort Stewart	93	93	101	50	41	85	235	228
<b>Total</b>	<b>315</b>	<b>315</b>	<b>256</b>	<b>236</b>	<b>485</b>	<b>334</b>	<b>1056</b>	<b>885</b>

Today's ASMP fleet of railcars has a requirement for 1,056 general-purpose 40000/41000/42000-series flatcars. Currently, there are 885 of these types of flatcars in the ASMP fleet. According to Mr Mike Bundshuh of the U.S. Army's Tank and Automotive Command (TACOM), 125, 42000-series flatcars will be delivered to the ASMP fleet by the end of FY 2000, and another 26, 42000-series flatcars will be added to the ASMP fleet in early FY 2001. An additional 31, 42000-series flatcars are out for contract and will be delivered to the ASMP fleet no later than the end of FY 2001 (Bundshuh, 2000). Following the deliveries of these newly acquired 40000/41000/42000-series flatcars, the ASMP fleet will be at full strength by the end of FY 2001.

### Conclusion

The ability of U.S. forces to change rapidly from a peacetime to a wartime force (to mobilize and deploy) is vitally important to national security. Today's Army is heavily reliant on both commercial and DoD flatcar assets to transport wheeled/tracked vehicles from home stations to ports of embarkation to meet prescribed mobilization and deployment timelines.

Today's commercial general-purpose flatcar inventory consists of 9,768 railcars. Of these flatcars, 6,973 are chain equipped while 2,795 have nailable decks only. Today's commercial flatcar fleet is capable of carrying every wheeled/tracked vehicle in the Army inventory. If today's commercial general-purpose flatcar retirement and

purchasing trends continue, the commercial industry is expected to own fewer than 4,200 militarily useful flatcars by the year 2011.

Today's ASMP fleet consists of 885 DODX 40000/41000/42000-series chain-tiedown flatcars. The health of this fleet will improve over the next two years with the addition of 182 new flatcars. The primary purpose of the ASMP fleet of railcars is to meet surge requirements during the first week of a contingency and to offset potential commercial flatcar shortages during subsequent weeks of a mobilization

The next chapter will compare current/future commercial and DoD flatcar inventories as discussed in this chapter with mobilization requirements presented in chapter 4 of this research paper. Since MRS-05's near-simultaneous MTW scenario has the greatest requirement for general-purpose flatcars during both initial surge and peak operations, its requirements will be used as the basis for any comparisons in the next chapter.

## VI. Conclusions and Recommendations

### Introduction

Today's fleet of commercial and DoD militarily useful general-purpose flatcars is sufficient in number and type to meet all mobilization and deployment requirements stated in the draft Mobility Requirements Study 2005 and the Army's Surface Distribution Plan #2 through at least 2002. However, future inventories of militarily useful flatcars within the commercial sector will likely become insufficient in quantity due to current flatcar production and retirement trends. If the current trends continue, future military useful flatcar inventories will become inadequate by 2005.

### Conclusions

Today's commercial flatcar inventory consists of 9,768 60-foot equivalent militarily useful general-purpose flatcars. An inventory of 4,046 60-foot equivalent flatcars would be required to meet MRS-05 initial surge operations while an inventory of 8,239 60-foot equivalents would be needed to meet MRS-05's peak operations requirements.

Figure 14 depicts past, present and future combined inventories of commercial and DoD general-purpose flatcars. Today's fleet of ASMP flatcars consists of 315 40000-series, 236 41000-series and 334 42000-series railcars. This fleet of flatcars equates to 1,052 60-foot equivalents. By the end of FY 2001, an additional 182 42000-series flatcars will be added to the ASMP fleet, increasing its numbers to 1,325 60-foot equivalent flatcars. Because of its relatively young age, the DoD ASMP fleet of flatcars should remain in service until at least 2030.

Figure 14 also shows that there are 9,768 militarily useful general-purpose flatcars in the commercial inventory today. However, if current retirement and purchasing trends continue, the commercial industry will be left with only 4,200 general-purpose flatcars by 2011. This quantity of flatcars will barely be enough to support initial surge operations, let alone peak operational requirements in support of MRS-05's near simultaneous MTW scenario.

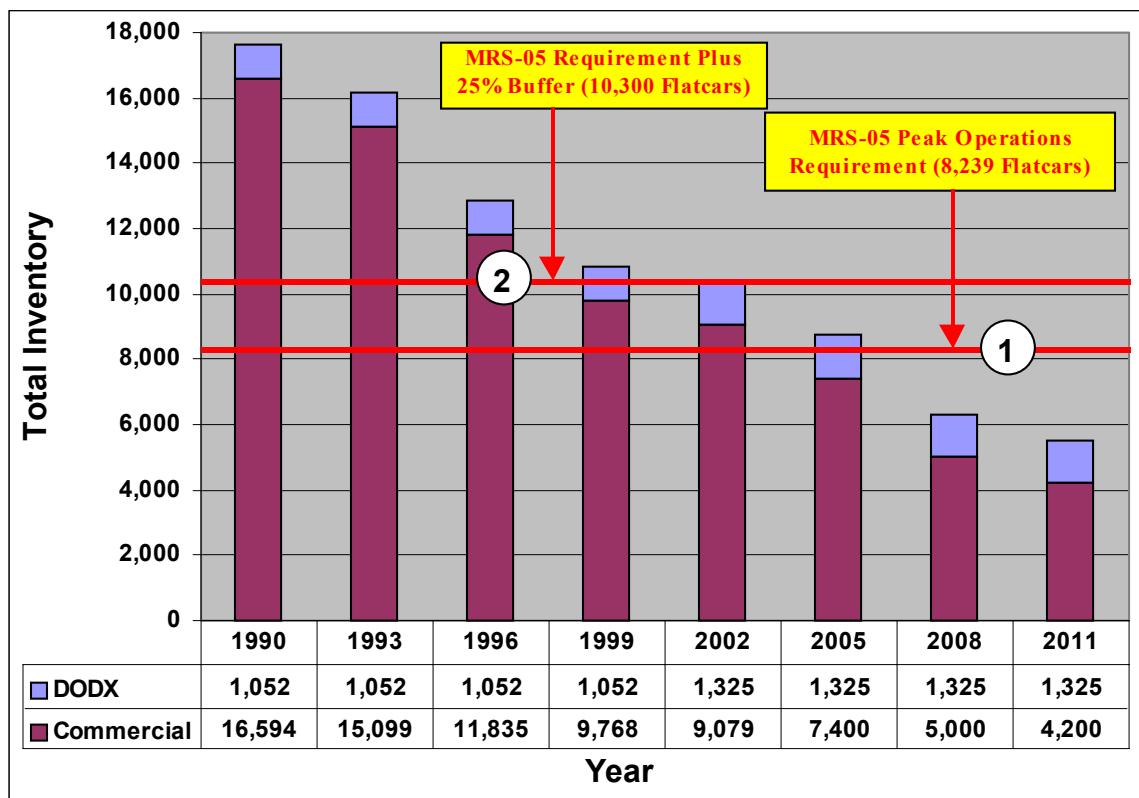


Figure 14. MRS-05 Peak Requirement and Future 60-Foot Equivalent General-Purpose Flatcar Inventories (Dorfman and Brumbaugh, 2000)

The first line in Figure 14 depicts the peak operational flatcar requirement for MRS-05. This line assumes all commercial and ASMP general-purpose flatcars will be available to support the mobilization and deployment requirements of a near-

simultaneous MTW scenario. Based on this first line, the combined commercial and DoD general-purpose flatcar fleets will be marginally capable of supporting the mobilization and deployment requirements of MRS-05 until 2005. However, this same fleet of flatcars will become inadequate as early as 2006.

The second line depicted on Figure 14 depicts the peak flatcar requirement of MRS-05 plus a 25-percent buffer to account for likely inefficiencies in the commercial and DoD flatcar fleets. According to MTMCTEA's flatcar representative:

Merely having the minimum quantity of general-purpose flatcars in the inventory could cause spot shortages and delays during a mobilization for several reasons. Up to 10-percent of the flatcars in the inventory could be down for maintenance, priority civilian traffic must still be handled, and there will always be some lost time and last minute changes in an actual mobilization. For these reasons, we believe that the inventory should exceed the baseline requirement by at least 25-percent to minimize spot shortages, and allow for flexibility. (Dorfman, 2000:5)

Based on this second line, the combined commercial and DoD general-purpose flatcar fleets will be capable of supporting the mobilization and deployment requirements of MRS-05 until 2002. However, this same fleet of flatcars will become inadequate as early as 2005.

The next section discusses several options that could be implemented to ensure future flatcar inventories are sufficient in number and type to meet mobilization and deployment requirements as stated in MRS-05 and SDP-2.

### Recommendations

Today's combined fleet of commercial and DoD militarily useful flatcars is sufficient in number and type to meet MRS-05 and SDP-2 mobilization and deployment requirements. However, future inventories of militarily useful flatcars will become

insufficient in quantity unless actions are taken to increase the overall number of flatcars in the commercial and/or DoD inventories. This section recommends four possible options for consideration.

Option One. Purchase and preposition additional DODX 42000-series chain-tiedown flatcars at power projection bases. According to MTMC's flatcar purchasing agent, the 89-foot 42000-series chain-tiedown flatcar is the most versatile DODX flatcar because it can transport the full spectrum of Army wheeled/tracked vehicles as well as a variety of ammunition containers (Gounley, 2000). Purchasing additional 42000-series medium-duty flatcars would provide two benefits: better enable the Army to fully respond during the first week of a mobilization when the commercial rail industry might not be able to and help offset any potential commercial railcar shortages during subsequent weeks of a mobilization.

Despite the benefits of purchasing additional 42000-series flatcars, there are also several drawbacks. The first drawback associated with purchasing additional 42000-series chain-tiedown flatcars is their cost. To fully meet the projected commercial and DoD flatcar inventory shortfall in 2008, a minimum of 1,914 42000-series flatcars would need to be purchased at a cost of \$191.4 million (one 42000-series flatcar costs \$100,000) (Dorfman, 2000). Purchasing 1,914 additional 42000-series flatcars would ensure the minimum MRS-05 mobilization and deployment requirements (line one in Figure 14) could be met.

Another drawback to purchasing large numbers of DODX 42000-series flatcars is the space required to park 1,914 additional flatcars at power projection bases. Prepositioning large numbers of flatcars at power projection bases could actually hinder

out-loading efforts by over saturating these bases with too many railcars. Additionally, since prepositioned ASMP railcars are used almost exclusively for contingency operations, the Army could end up with an additional 1,914 42000-series flatcars eventually requiring extensive and costly upkeep as a result of under-utilization during peacetime.

Option Two. Extend service life of general-purpose militarily useful flatcars in the commercial industry. The majority of today's commercial general-purpose flatcar fleet was built in the mid to late-1960s. According to MTMCTEA's flatcar representative: flatcars built in 1963 or earlier will be retired from the commercial fleet no later than 2004; flatcars built between 1964 and June 30, 1974 must retire at 40 years unless they receive a service life extension; and flatcars built after June 30, 1974 are automatically eligible for a 50-year service life (Dorfman, 2000).

Extending the service lives (from 40 to 50 years) of large numbers of militarily useful commercial flatcars built between 1964 and 1974 would significantly reduce projected commercial flatcar shortfalls over the next ten years. Future flatcar inventories in Figure 14 are based on a conservative 30-percent service life extension of general-purpose flatcars in the commercial inventory. Based on this 30-percent service life extension for commercial railcars, an inventory of only 4,200 general-purpose flatcars would exist in 2011. According to the Director of General Equipment at TTX Company, service life extensions on 100-percent of all commercial general-purpose flatcars built between 1964 and 1974 would be possible (Flagello, 2000). Assuming a service life extension rate of 100-percent, the commercial general-purpose railcar inventory could remain at or above 8,754 flatcars until at least 2011. By implementing this service life

extension option by itself, the commercial general-purpose flatcar inventory alone could meet MRS-05 mobilization and deployment requirements through 2011 (line one in Figure 14).

According to representatives from the commercial and DoD rail industries, inspecting and approving service life extensions on commercial general-purpose flatcars is relatively inexpensive and requires minimal time (two days at most) (Flagello and Gounley, 2000). First, a sampling of railcars from a specific railcar category is taken. Next, this sampling of railcars is inspected to ensure the railcars meet required load and stress specifications. Then, if the majority of cars from a sampling pass inspection, the entire category of railcar can receive service life extensions through 50-years of service.

According to Mr. John Flagello, Director of General Equipment at TTX Company, both private and military customers want the commercial rail industry to keep these older general-purpose flatcars in service till they reach the end of their 50-year service life. Over the past year, business has been good and is expected to remain so for the foreseeable future. Additionally, since these general-purpose flatcars are “already paid for and can still get the job”, there is no need to replace them with new more expensive railcars (Flagello, 2000).

Option Three. Modify commercially owned JTTX flatcars to transport wheeled/tracked vehicles. As previously mentioned, to be considered militarily useful, a commercial railcar must meet four suitability requirements. First, the Association of American Railroads must designate the railcar as a FM or FMS (general-purpose) flatcar. Second, the railcar must have a nailable deck and/or chain-tiedown assemblies to secure wheeled/tracked vehicles during transportation. Third, the railcar must not have

obstructions or bulkheads that would prevent military vehicles from being “circus loaded”. Finally, the railcar must meet Army length, width and load limit (weight) requirements necessary in transporting wheeled/tracked vehicles.

According to TTX’s Director of General Equipment, JTTX “steel flatcars” would only require the purchase of chain-tiedown assemblies in order to become militarily useful (Flagello, 2000). The cost of outfitting JTTX flatcars with chain-tiedown assemblies would run about \$6,400 (\$200 per assembly) per railcar (Gounley, 2000). To ensure maximum flexibility and responsiveness during contingency operations, chain-tiedown assemblies purchased for JTTX flatcars could be stockpiled at each of the power projection bases.

In late 1999 and early 2000, TTX Company purchased 600 new JTTX railcars. TTX is expected to purchase an additional 150 JTTX “steel flatcars” by the end of 2000 (Flagello, 2000). The addition of 750 more militarily useful flatcars to the projected commercial general-purpose flatcar inventories of Figure 14 will go a long way towards meeting MRS-05 mobilization and deployment requirements over the next ten years.

Option Four. Design and purchase a multi-purpose universal railcar for commercial and DoD use. According to representatives from MTMC and TTX, initial discussions are under way that may lead to the design and procurement of a railcar that could be used by the commercial industry to transport both wheeled/tracked vehicles as well as 20-foot/40-foot intermodal containers (Flagello and Gounley, 2000). According to Mr. John Flagello of TTX, this universal railcar would be very similar to the DoD’s 42000-series flatcar. The universal railcar would be 89-feet long, capable of carrying intermodal containers or military wheeled/tracked vehicles weighing of up to 100 tons

and capable of being loaded from either end or side ramps (Gounley, 2000). Unlike the majority of today's "specific purpose" railcars, a universal railcar could enable the commercial and DoD rail industries to transport a variety of equipment an/or containers during both peacetime and wartime efforts.

### Summary

Today's combined fleet of commercial and DoD general-purpose flatcars is sufficient in number and type to meet the most restrictive mobilization and deployment requirements of MRS-05 and SDP-2. However, future inventories of general-purpose flatcars will likely become inadequate by 2005.

To ensure future inventories of general-purpose flatcars are sufficient in number and type, extensive changes must be implemented now to offset projected losses in the commercial industry's total general-purpose flatcar inventory. Several options include: purchasing and prepositioning additional DODX 42000-series chain-tiedown flatcars at power projection bases, extending the service life of militarily useful flatcars in the commercial industry, modifying commercially owned railcars to transport wheeled/tracked vehicles, and designing/procuring a multi-purpose universal railcar for commercial and DoD use.

Implemented alone, each of the above options will go a long way towards bolstering future commercial and DoD flatcar inventories. Implemented together, the above options will ensure commercial and DoD flatcar inventories meet MRS-05 mobilization and deployment requirements well into the next decade.

## Appendix A: Acronyms

AAR	Association of American Railroads
ALD	Available to Load Date
AMC	Army Material Command
APOE	Aerial Port of Embarkation
ASMP	Army Strategic Mobility Program
BFV	Bradley Fighting Vehicle
BNSF	Burlington Northern Santa Fe Railroad
CINC	Commander-in-Chief
COFC	Container-On-Flatcar
CONUS	Continental United States
CSA	Chief of Staff, United States Army
CSX	CSX Corporation
CSXT	CSX Transportation Incorporated (CSX rail subsidiary)
DFRIF	Defense Freight Railway Interchange Fleet
DFSC	Defense Fuel Supply Center
DoD	Department of Defense
DODX	Department of Defense Railcar
DTS	Defense Transportation System
FORSCOM	Forces Command
FY	Fiscal Year
GAO	General Accounting Office
HEMTT	Heavy Expanded Mobility Tactical Truck
HMMWV	High Mobility Multipurpose Wheeled Vehicle
HQ MTMC	Headquarters Military Traffic Management Command
IOC	Industrial Operations Command
JCS	Joint Chiefs of Staff
KCSR	Kansas City Southern Railway
LMI	Logistics Management Institute
MOOTW	Military Operations Other Than War
MRC	Major Regional Conflict
MRS	Mobility Requirements Study

MRS BURU	Mobility Requirements Study, Bottom-Up Review Update
MRS-05	Mobility Requirements Study 2005
MSC	Military Sealift Command
MTMC	Military Traffic Management Command
MTMCDSC	Military Traffic Management Command, Deployment Support Command
MTMCTEA	Military Traffic Management Command, Transportation Engineering Agency
MTONS	Million Tons
MTW	Major Theater War
NS	Norfolk Southern Railway
OPLAN	Operations Plan
OSC	Operations Support Command
PB	Presidential Budget
POE	Port of Embarkation
SDP-2	Surface Distribution Plan # 2
SP	Southern Pacific Railroad (now part of Union Pacific Railroad)
SPOE	Seaport of Embarkation
TACOM	Tank and Automotive Command
TPFDD	Time-Phased Force Deployment Data
UP	Union Pacific Railroad
USTRANSCOM	United States Transportation Command

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## Vita

Major Dwight Sones was born in Wilkensberg, Pennsylvania.

Following graduation from Annandale high school, Virginia in 1983, he attended the Pennsylvania State University and received a Bachelor of Science degree in Aerospace Engineering and his Air Force commission through the Reserve Officer Training Corps in May 1988. In 1995, he received Master of Arts degrees in Public Administration and Human Resource Development from Webster University, in St Louis, Missouri.

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<b>REPORT DOCUMENTATION PAGE</b>				<i>Form Approved OMB No. 074-0188</i>
<p>The public reporting burden for this collection of information is estimated to average 1 hour per response, including the time for reviewing instructions, searching existing data sources, gathering and maintaining the data needed, and completing and reviewing the collection of information. Send comments regarding this burden estimate or any other aspect of the collection of information, including suggestions for reducing this burden to Department of Defense, Washington Headquarters Services, Directorate for Information Operations and Reports (0704-0188), 1215 Jefferson Davis Highway, Suite 1204, Arlington, VA 22202-4302. Respondents should be aware that notwithstanding any other provision of law, no person shall be subject to an penalty for failing to comply with a collection of information if it does not display a currently valid OMB control number.</p> <p><b>PLEASE DO NOT RETURN YOUR FORM TO THE ABOVE ADDRESS.</b></p>				
<b>1. REPORT DATE (DD-MM-YYYY)</b> Oct 03	<b>2. REPORT TYPE</b>			<b>3. DATES COVERED (From – To)</b> Jan 99- Jan 00
<b>4. TITLE AND SUBTITLE</b>  Can the Rail Industries Flatcar Inventory Support Two Major Theater Wars?			<b>5a. CONTRACT NUMBER</b>  <b>5b. GRANT NUMBER</b>  <b>5c. PROGRAM ELEMENT NUMBER</b>	
<b>6. AUTHOR(S)</b> 7. Dwight C. Sones, Major, USAF			<b>5d. PROJECT NUMBER</b>  <b>5e. TASK NUMBER</b>  <b>5f. WORK UNIT NUMBER</b>	
<b>7. PERFORMING ORGANIZATION NAMES(S) AND ADDRESS(S)</b>  Air Force Institute of Technology Graduate School of Engineering and Management (AFIT/EN) 2950 HobsonStreet, Building 640 WPAFB OH 45433-7765				<b>8. PERFORMING ORGANIZATION REPORT NUMBER</b>  AFIT/GMO/ENS/00E-11
<b>9. SPONSORING/MONITORING AGENCY NAME(S) AND ADDRESS(ES)</b>				<b>10. SPONSOR/MONITOR'S ACRONYM(S)</b>  <b>11. SPONSOR/MONITOR'S REPORT NUMBER(S)</b>
<b>12. DISTRIBUTION/AVAILABILITY STATEMENT</b> APPROVED FOR PUBLIC RELEASE; DISTRIBUTION UNLIMITED.				
<b>13. SUPPLEMENTARY NOTES</b>				
<b>14. ABSTRACT</b> <p>The ability of U.S. forces to change rapidly from a peacetime to a wartime force (to mobilize and deploy) is vitally important to national security. Successful execution of these movements depends, in large part, on the availability of the required transportation resources. Today's Army is heavily dependent on Department of Defense (DoD) and commercial railcar assets to move its wheeled/tracked vehicles from home forts to seaports of embarkation (SPOEs) to meet prescribed mobilization and deployment timelines.</p> <p>The primary research question answered by this paper is: Can U.S. military and commercial flatcar inventories meet DoD mobilization requirements for Army wheeled/tracked vehicles during two near-simultaneous major theater wars (MTWS)? This paper compares commercial and military flatcar requirements as stated in DoD deployment plans with current/future flatcar inventories to determine whether railcar inventories (both commercial and DoD) are sufficient in number and type to meet a two MTW scenario.</p> <p>Today's fleet of commercial and DoD flatcars is sufficient in number and type to support two near-simultaneous MTWs. However, future inventories of commercial general-purpose flatcars will likely be insufficient due to current railcar production and retirement trends. Several recommendations are presented to ensure future inventories of militarily useful flatcars will be sufficient in number and type, to meet DoD mobilization requirements in support of the two near simultaneous MTWs.</p>				
<b>15. SUBJECT TERMS</b>				
<b>16. SECURITY CLASSIFICATION OF:</b>		<b>17. LIMITATION OF ABSTRACT</b>	<b>18. NUMBER OF PAGES</b>	<b>19a. NAME OF RESPONSIBLE PERSON</b> Lt Col Stephan, Brady , USAF (ENS)
REPORT U	ABSTRACT U	c. THIS PAGE U	UU	<b>19b. TELEPHONE NUMBER</b> (Include area code) (937) 255-6565, ext 4367; e-mail: Stephan.brady@afit.edu